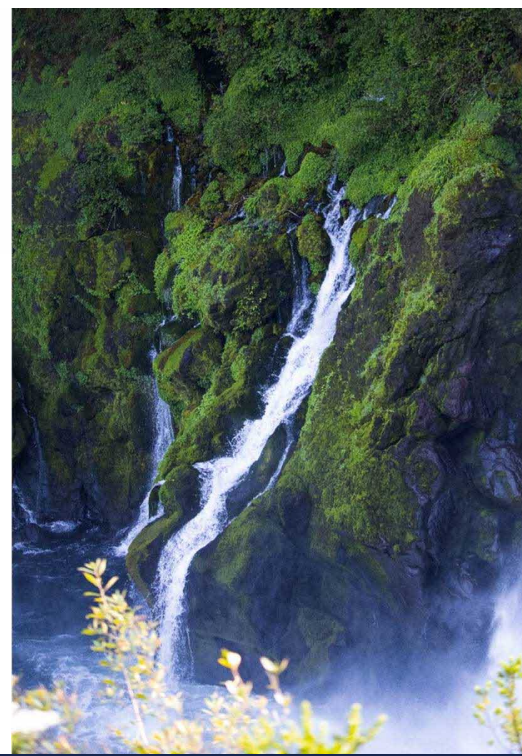




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Flood risk, water and environment

Flood Risk Assessment and Surface Water Drainage Strategy AEG0493_P010_Emsworth_01

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Flood risk, water and environment

Document Issue Record

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Prepared for: Michael John Hughes

Reference: AEG0493_PO10_Emsworth_01

Site Location: 41 Beach Road, Emsworth, Havant, PO10 7HR

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Amendments Summary (v1.01):

The amendments to this report on 30/05/2023 include the Surface Water Drainage Strategy (Section 7) and any subsequent updates were made to the Conclusion (Section 7). Revisions were also made to the Flood Risk Assessment sections to account for revised plans and FFLs.

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Summary

Development Description	Existing	Proposed
Development Type	A Residential Dwelling	Demolition of the existing dwelling and the construction of a replacement dwelling.
EA Vulnerability Classification	More Vulnerable	More Vulnerable
Ground Floor Level	Approximately 3.73m AOD to 4.91m AOD based on EA 1m LiDAR. Finished Floor Levels (FFLs) is 4.26m AOD.	FFL of the house to be set 600mm above existing FFL, at 4.86m AOD. FFL of the garage to be set 300mm above existing FFL, at 4.56m AOD
Level of Sleeping Accommodation	Ground and First Floor	Ground and First Floor
Surface Water Drainage	N/A ¹	See Section 6 of this report.
Site Size	Approximately 304m ²	No change.
Risk to Development	Summary	Comment
EA Flood Zone	Flood Zones 1, 2 and 3	
Flood Source	Tidal	
SFRA Available	Yes –The Partnership for Urban South Hampshire (PUSH) SFRA ¹ (2016)	
Management Measures	Summary	Comment
Ground floor level above extreme flood levels	No	Analysis of the EA data indicates that the site and proposed FFLs are below the 1:200 (0.5% AEP) year + CC tidal flood event levels, so prior evacuation is recommended.
Safe Access/Egress Route	No	Flood depths on Beach Road could exceed 250mm in the 1:200 year +CC calculated events and thus prior evacuation is recommended. If not possible, temporary refuge should be

¹ <https://www.portsmouth.gov.uk/wp-content/uploads/2021/12/PUSH-Strategic-Flood-Risk-Assessment-2016-update-main-report-February-2016-accessible.pdf>

Flood Resilient Design Site Drainage Plan Flood Warning & Evacuation Plan		sought at the first floor above calculated flood levels until the tide recedes.
	Yes	Recommendations suggested in Section 5 of this report
	No	See Section 6 of this report.
	No	Residents should sign up to the EA Flood Warning Service –Langstone and Emsworth
Offsite Impacts	Summary	Comment
Displacement of floodwater	Negligible	The dominant flood risk at the site location is from a tidal source. As such, any increase in flood risk elsewhere through displacement could be considered negligible.
Increase in surface run-off generation	N/A ¹	Surface Water Drainage Strategy recommended for planning application
Impact on hydraulic performance of channels	None	The site is not within the vicinity of any ordinary watercourses.

¹ not required for this assessment

² data not available.

1. Introduction

- 1.1. Aegaea were commissioned by Michael John Hughes to undertake a Flood Risk Assessment (FRA) and Surface Water Drainage Strategy (SWDS) to accompany a pre-application for the proposed development. This FRA and SWDS has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance.
- 1.2. This FRA and SWDS is intended to support a full planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.

Site Overview

- 1.3. The site of the proposed development is 41 Beach Road, Emsworth, Havant, PO10 7HR (Figure 1).

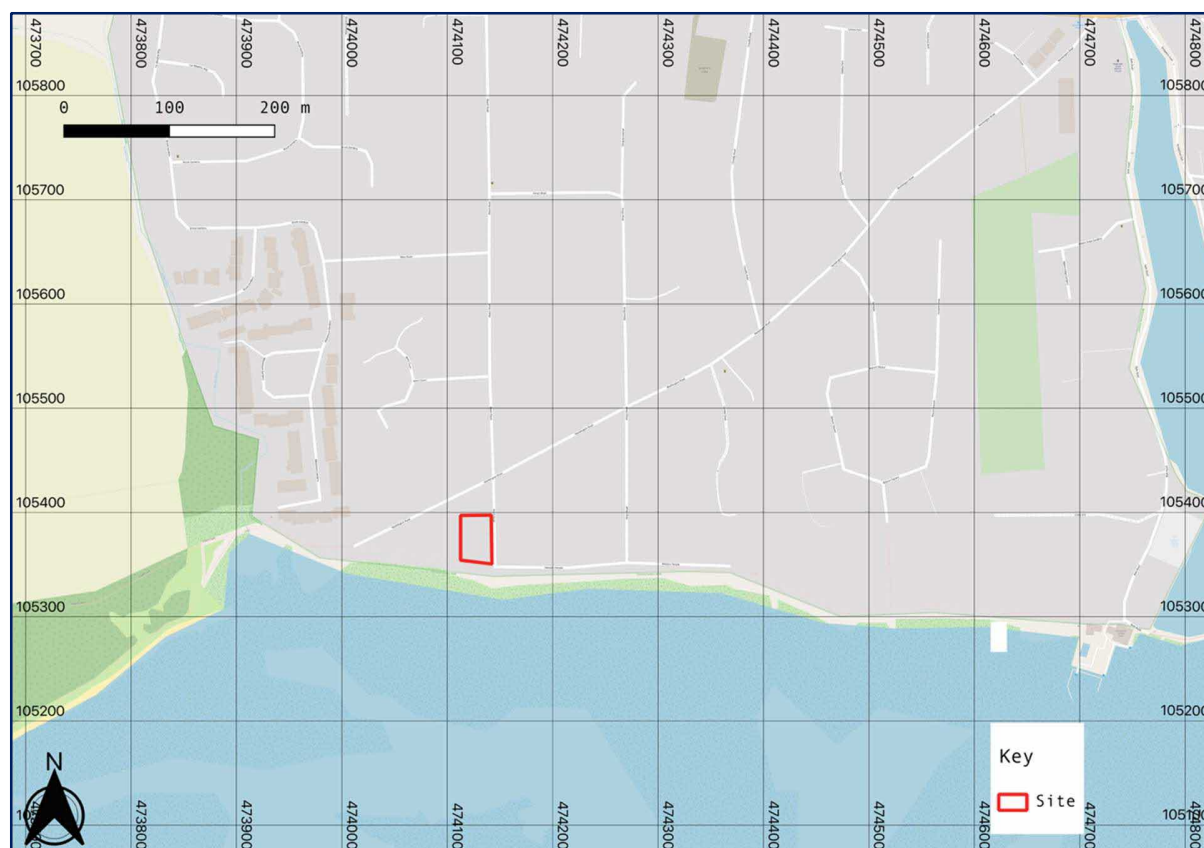


Figure 1: Site Location (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

- 1.4. The existing site is a residential dwelling. The proposed development is for the demolition of the existing dwelling and the construction of a replacement dwelling (see Appendix A for development proposals).

- 1.5. The topographic survey provided by the client (Appendix B) indicates that the existing dwelling has a threshold level of 4.26m AOD (and thus an assumed Finished Floor Level (FFL) of 4.26m AOD).
- 1.6. The ground floor FFL of the replacement dwelling is to be increased by 600mm to 4.86m AOD; the proposed garage will increase by 300mm to 4.56m AOD.
- 1.7. Environment Agency Light Detection and Ranging (LiDAR) data Digital Terrain Model (1m resolution) has been utilised to visualise the topography of the site.

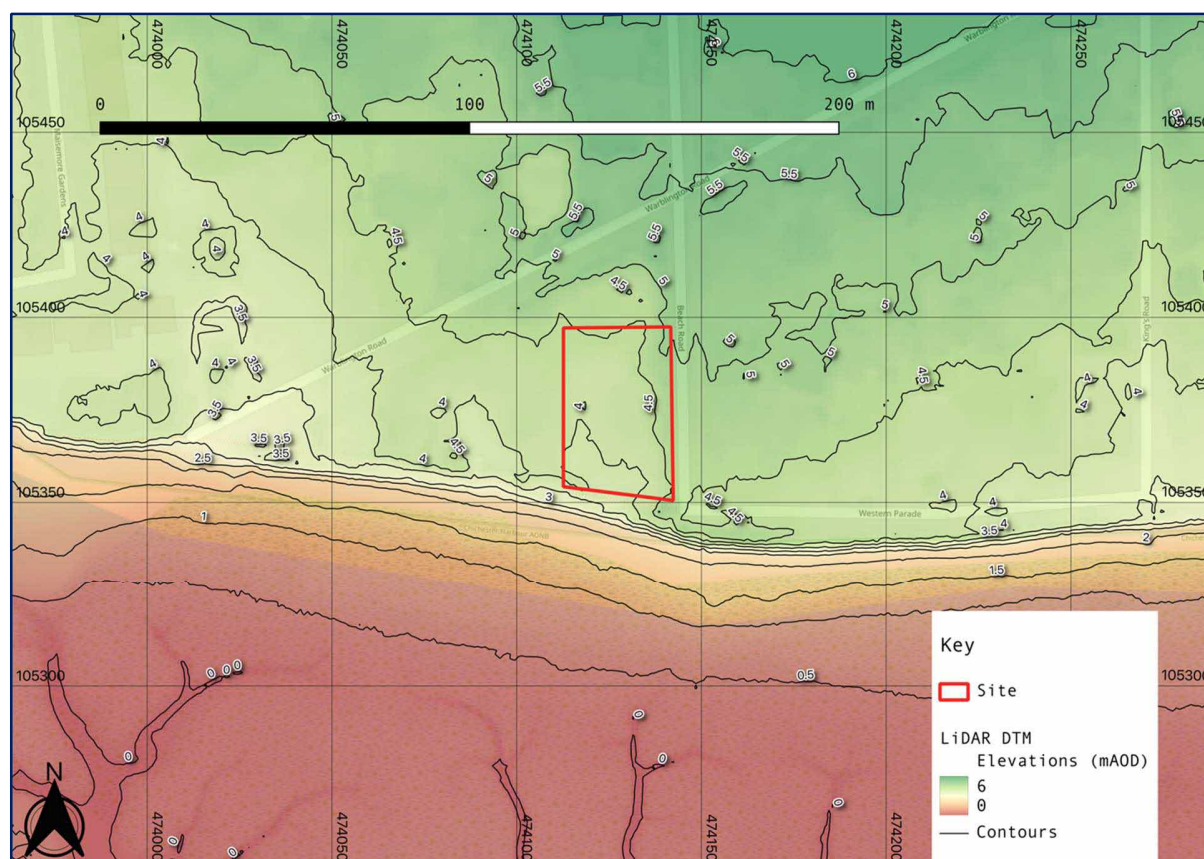


Figure 2: Site Topography (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

- 1.8. Havant Borough Council is the Local Planning Authority (LPA) for the site, and Hampshire County Council is the designated Lead Local Flood Authority (LLFA). The site sits within the Environment Agency's Solent and South Downs region.

Planning Policy and Guidance

1.9. UK government planning guidance states² that an FRA is required for sites which are:

- *In Flood Zone 2 or 3 including minor development and change of use*
- *More than 1 hectare in Flood Zone 1*
- *Less than 1 ha in Flood Zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than river and the sea (for example surface water drains or reservoirs)*
- *In an area within Flood Zone 1 which has critical drainage problems as notified by the Environment Agency*

1.10. The site is partially located within Flood Zones 2 and 3, therefore an FRA is required in accordance with the NPPF.

1.11. The objective of this FRA is to demonstrate that the proposals are acceptable in terms of flood risk. This report summarises the findings of the study and specifically addresses the following issues in the context of the current legislative regime:

- Tidal flood risk
- Surface water flood risk
- Risk of flooding from other sources

² <https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications#when-you-need-an-assessment>

2. Planning Policy

National Planning Policy Framework

- 2.1. Inappropriate development in a flood risk area could pose significant risk in terms of personal safety and damage to property for the occupiers of the development or for people elsewhere. The approach taken in the assessment of flood risk at the planning stage is set out in national, regional, and local planning policy and associated guidance. This section summarises the key policies and guidance relevant to the proposed development.
- 2.2. The National Planning Policy Framework³ (NPPF) (DCLG, 2021) includes Government policy on development and flood risk stating that:

“159. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

167. When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;*
- the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;*
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- any residual risk can be safely managed; and*
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.*

168. Applications for some minor development and changes of use should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 55. “

³ <https://www.gov.uk/guidance/national-planning-policy-framework>, last updated July 2021

2.3. Footnote 55 of the NPPF states:

“A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.”

2.4. Flood Zones in England are defined as follows:

Table 1: Flood Zone Definitions

2.5. Flood Zone	2.6. Definition
Zone 1 Low Probability	Land having less than 1 in 1,000 annual probability of river or sea flooding (all land outside Zones 2 and 3).
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
Zone 3b The Functional Floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: - land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or - land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

- 2.7. An FRA should be appropriate to the scale, nature, and location of the development. It should identify and assess the risk from all sources of flooding to and from the development and demonstrate how any flood risks will be managed over the lifetime of the development.

Local Plan

- 2.8. The Core Strategy⁴ (2011) prepared by the Local Planning Authority, Havant Borough Council, sets out the policies for development in the local area.
- 2.9. The Core Strategy contains Policy CS15 which details the specific flood and coastal erosion risk management strategies for the area:

Policy CS15 Flood and Coastal Erosion Risk

⁴ <https://cdn.havant.gov.uk/public/documents/ADOPTED%20CORE%20STRATEGY%20.pdf>

Development in areas at risk of flooding now and in the future as identified on the latest Environment Agency flood risk maps and Strategic Flood Risk Assessment climate change maps will only be permitted where:

- 1. It meets the sequential and exception test (where required) in relation to PPS25.*
- 2. The site is located in a low hazard area as defined in the Strategic Flood Risk Assessment.*
- 3. A site-specific flood risk assessment demonstrates that the development will be safe, including the access, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*
- 4. The scheme incorporates flood protection, flood resilience and resistance measures appropriate to the character and biodiversity of the area and the specific requirements of the site.*
- 5. Appropriate flood warning and evacuation plans are in place.*
- 6. New site drainage systems are designed taking account of events which exceed the normal design standard.*

All development will be required to ensure that there is no net increase in surface water run off. Priority should be given to incorporating Sustainable Drainage Systems (SuDS) to manage surface water drainage, unless it is proven that SuDS are not appropriate. Where SuDs are provided arrangements must be put in place for their whole life management and maintenance.

The council will work with partners to implement the Coastal Policy Zones in the North Solent Shoreline Management Plan to ensure that development avoids areas at risk from coastal erosion and coastal flooding and that areas required to offset coastal squeeze and prevent habitat fragmentation, to allow species to adapt to climate change, are identified and protected from development.

Sequential and Exception Tests

- 2.10. The Sequential and Exception Tests are applied in specific cases defined by UK Government policy. Their purpose is to drive development to areas of low flood risk and to support developments which improve flood risk for developments in areas at risk of flooding.
- 2.11. Under the NPPF all new planning applications should undergo a Sequential Test accordance with paragraph 168 and footnotes 55 and 56. This test should be implemented by local planning authorities with a view to location particularly vulnerable new developments outside of the flood plain.
- 2.12. However, the proposal is for the demolition of an existing dwelling, and the construction of a replacement dwelling at the same site and thus, it is not pragmatic to suggest locating the dwelling at a different site at a lower risk of flooding.

Summary

- 2.13. This flood risk assessment has been prepared with due consideration to the above local and national policy.

3. Consultation and Review

Sources of Information

Consultation

- 3.1. The site is within the remit of Hampshire County Council as Lead Local Flood Authority (LLFA). The EA have provided a Product 4 and Product 6 dataset.
- 3.2. The Product 4 will be included within Appendix C.

Documents

- 3.3. Local Governments and Lead Local Flood Authorities provide documents which contain data and policies on flood risk and new development in their areas. These documents are introduced and briefly summarised below. For the purposes of this FRA, these documents have been reviewed for relevant information and any relevant data is discussed within the appropriate sub heading of this report.
- 3.4. The following sources of information have been reviewed for this assessment:
 - The Interactive Flood Risk Mapping available on the Environment Agency (EA) website⁵.
 - The National Planning Policy Framework (NPPF) technical guide (Communities and Local Government, 2019).
 - British Geological Survey - Geology of Britain Viewer (British Geological Society, 2017).
 - Havant Borough Council Core Strategy ⁶ (2011).
 - Hampshire County Council Preliminary Flood Risk Assessment⁷ (PFRA), (2011).
 - The Partnership for Urban South Hampshire (PUSH) SFRA⁸ (2016)
 - The North Solent Shoreline Management Plan⁹ (2010)

⁵ Environment Agency, Flood Map for Planning, <https://flood-map-for-planning.service.gov.uk/>, 2017

⁶ <https://cdn.havant.gov.uk/public/documents/ADOPTED%20CORE%20STRATEGY%20.pdf>

⁷ https://documents.hants.gov.uk/flood-water-management/watercourses/PFRAResportsavedJan2016.pdf?_gl=1*1lz90e*_ga*MTA0Mzk4NzYyNy4xNjU1ODE4ODU0*_ga_8ZVSPZWL5T*MTY1NTgxODg1NC4xLjAuMTY1NTgxODg1NC4w

⁸ <https://www.portsmouth.gov.uk/wp-content/uploads/2021/12/PUSH-Strategic-Flood-Risk-Assessment-2016-update-main-report-February-2016-accessible.pdf>

⁹ https://www.northsolentsmp.co.uk/media/1574/NSSMP-Summary-Booklet-Dec-2010/pdf/NSSMP_Summary_Booklet_Dec_2010.pdf?m=637514898113500000

Preliminary Flood Risk Assessment (PFRA)

- 3.5. The PFRA, published in 2011, is a high-level appraisal of flood risk across Lead Local Flood Authority Hampshire County Council. The flood risk from all sources, including fluvial, surface water, groundwater and surcharged sewers is evaluated. It is the basis upon which the Local Flood Risk Management Strategy (described below) is produced.
- 3.6. The PFRA summarises historical flood incidents in Hampshire County Council. The site is not recorded as having been affected by any flood event.

Strategic Flood Risk Assessment (SFRA)

- 3.7. The SFRA, adopted in 2016, provides the evidence base for the Local Planning Authority Havant Borough Council Local Plan and guidance for consideration when determining planning applications. The SFRA seeks to place new development into areas of lower flood risk, taking into account current flood risk, future flood risk and the effect a proposed development would have on the risk of flooding.

4. Sources of Flood Risk

Tidal Flooding

- 4.1. After inspection from the EA's Flood Map for Planning, it can be found that a Southern portion of the site falls within Flood Zone 2 and 3 (Figures 3).

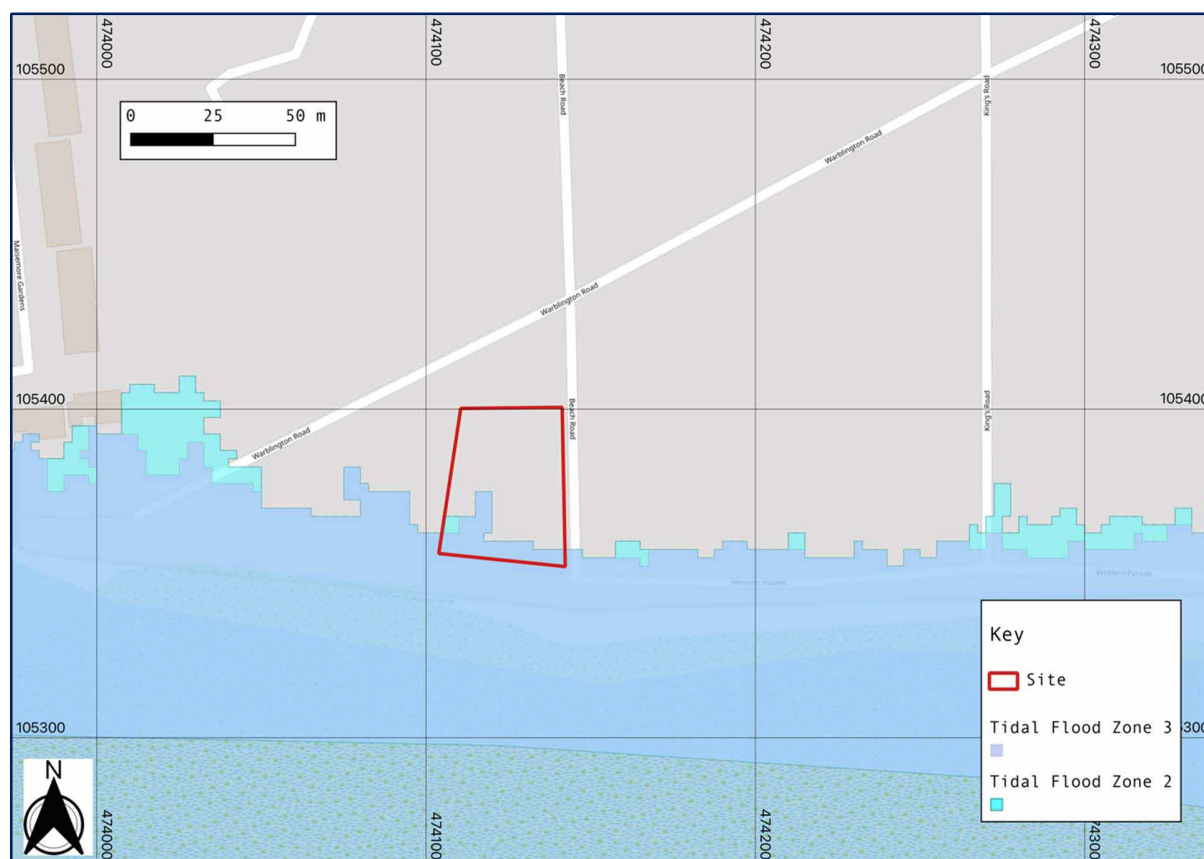


Figure 3 Tidal Flood Zone 2 (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

EA Product 4 Data

- 4.2. Product 4 data has been supplied by the EA for the site offering present day tidal flooding scenarios, scenarios with climate change allowances and information on the defence currently in place.

Present Day

- 4.3. Figure 4 details the points supplied by the Product 4 data set from which the present day flood levels have been taken from.

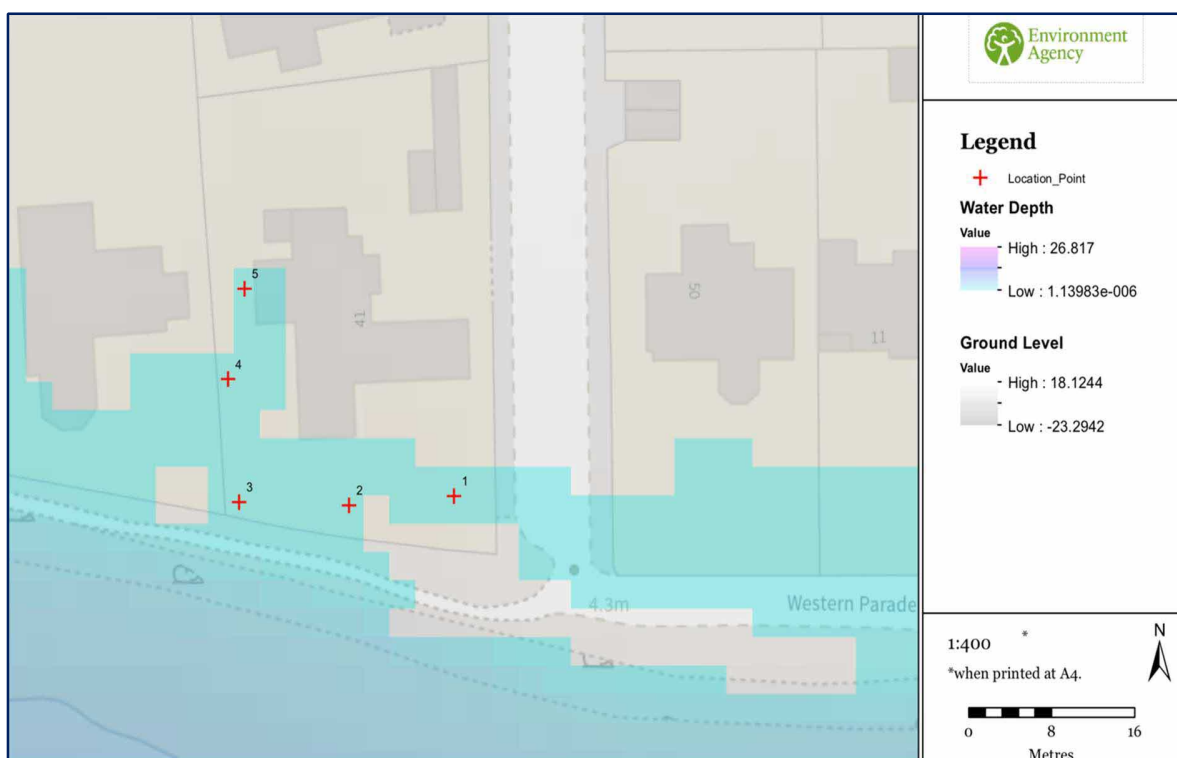


Figure 4 EA Product 4 Present Day Water Depths On Site

Present Day –1 in 200 year event

- 4.4. The EA have provided the flood level and flood depths at the 5 points detailed on Figure 4 for the 1:200 (0.5% AEP) Year, Present Day Event (Table 2):

Table 2 Present Day Water Depths for Tidal Flood Zone 3

Point	1:200 (0.5% AEP) Year Event		
	Ground Level (m AOD)	Water Surface Level (mAOD)	Water Depth (m)
1	4.06	No Data	No Data
2	3.81	3.82	0.01
3	3.83	3.87	0.04
4	3.95	4.04	0.09
5	4.00	4.04	0.04

- 4.5. The existing FFL of the house is 4.26m AOD based on the topographic survey provided. The proposed dwelling FFL will be 4.86m AOD while the garage FFL will be 4.56m AOD. As such, the existing and proposed FFLs are above the modelled 1:200 year present day flood levels for the site.

Present Day –1 in 1000 Year Event

- 4.6. The EA have also provided the water surface level and flood depths at the 5 points detailed on Figure 4 for the 1:1000 (0.1% AEP) Year, Present Day Event (Table 3) for Flood Zone 2.

Table 3 Present Day Water Depths and Levels for Tidal Flood Zone 2

1:1000 (0.1% AEP) Year Event			
Point	Ground Level (m AOD)	Water Surface Level (mAOD)	Water Depth (m)
1	4.06	4.07	0.01
2	3.81	3.84	0.03
3	3.83	3.88	0.05
4	3.95	4.05	0.10
5	4.00	4.05	0.05

- 4.7. The existing FFL of the house is 4.26m AOD based on the topographic survey provided. The proposed dwelling FFL will be 4.86m AOD while the garage FFL will be 4.6m AOD. As such, the existing and proposed FFLs are above the modelled 1:1000 year present day flood levels for the site.

Present Day - Summary

- 4.8. Given the proposed FFLs of both the house and the garage are to be set above the maximum flood levels in both the modelled 1:200 Year and the 1:1000 Year Event, the development is considered to be at a very low risk of flooding in the Present Day Scenarios.

Climate Change

- 4.9. The EA have also provided the water flood level and flood depths for the site with Climate Change projections.
- 4.10. Figure 5 details these Points within the site boundary which are within the 1 in 200 year tidal flood event with climate change projections.



Figure 5 EA Product 4 Water Depths with CC Considerations

- 4.11. However, the model was created in 2018, and the CC allowances for sea level rise have been updated since the production of the model¹⁰.
- 4.12. The latest climate change guidance presents this data in four epochs (2000 to 2035; 2036 to 2065; 2066 to 2095; 2096 to 2125) however for this site, the calculations require the sea level rise between the years 2018 (the year of the models production) to 2122 due to the proposal being for a residential dwelling, meaning a 100 year lifetime projection is necessary.
- 4.13. Therefore, the values for sea level rise per year have been scaled where required in order to produce the cumulative sea level rise in the years 2018 to 2122.
- 4.14. Table 4 presents these Water Depths and Levels on site with the updated CC allowances for the 1:200 (0.5% AEP) year event based on the Proposed FFLs.

¹⁰<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#sea-level-allowances>

Table 4 Water Depths and Levels on Site with Updated CC Allowances for Proposed FFLs

Area of England	Site Area and FFL	Allowance	Cumulative Rise 2018 to 2122 (m)	Updated Flood Level for 1:200 (0.5% AEP) Year Event (mAOD) Flood Zone 3	
				Max Water Surface Level (mAOD)	Water Depth (m)
South East	House (4.86m AOD)	Higher Central	1.060	5.10	0.24
		Upper End	1.422	5.46	0.60
	Garage (4.56m AOD)	Higher Central	1.060	5.10	0.54
		Upper End	1.422	5.46	0.90

- 4.15. To calculate the updated 1:200 Year Water Surface Levels shown in Table 4, the updated CC water levels have been added to the present day minimum and maximum water surface levels, shown in Table 2. The maximum modelled water surface level in the present day 1:200 Year event is 4.04m AOD.
- 4.16. To then gain the resulting water depths shown in Table 4, the proposed FFLs have been subtracted from these updated CC water surface levels to calculate a maximum flood depth for each scenario.
- 4.17. The proposed FFL for the house is 4.86m AOD whilst the proposed FFL for the garage is 4.56m AOD.
- 4.18. As such, the proposed garage could experience flood depths of 0.9m in the 1:200 year +CC (Upper End) event while in the same event, the proposed dwelling could experience flood depths of 0.6m.
- 4.19. These depths are considered significant however, the proposal is for the construction of a replacement dwelling, and the FFLs of the house are being raised 600mm and the garage 300mm, above the existing FFLs, thus providing a betterment compared to the existing situation.

Defence

- 4.20. Information on the flood defences that protect the site have also been provided by the EA, as seen in Figure 6.

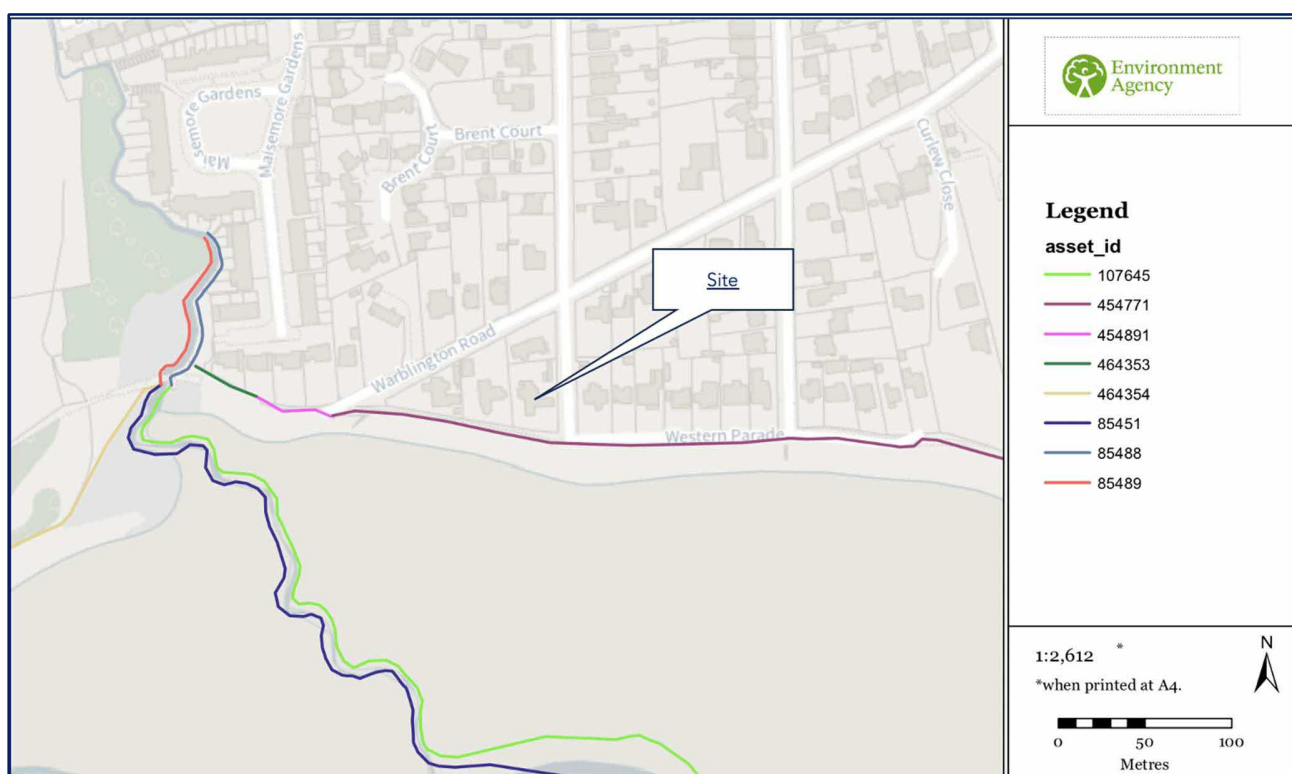


Figure 6 EA Product 4 Flood Defence Map

- 4.21. The defence protecting the site is Asset ID No. 454771. The Product 4 details this defence as Engineered High Ground but no data is provided about its current condition nor the standard of protection offered by this asset.

Summary

- 4.22. Based on the analysis within this report, the risk of tidal flooding to the proposed development in the present day, is considered low, however, when considering the impact of climate change, the risk of tidal flooding to the proposed development is considered high.
- 4.23. However, the proposal is for the construction of a replacement dwelling, and the FFLs of the house are being raised 600mm above the existing FFLs, thus providing a betterment compared to the existing situation.
- 4.24. Flood mitigation measures are recommended to be put in place to protect the site and its residents - this will be detailed in section 5 of this report.

Fluvial and Canal Flood Risk

- 4.25. There are no main rivers, ordinary watercourses or canals within the vicinity of the site, therefore the site is not considered to be at risk of fluvial or canal flooding.

Historical Flooding

4.26. As detailed in Figure 7, the site is outside any recorded and historical flood outlines.

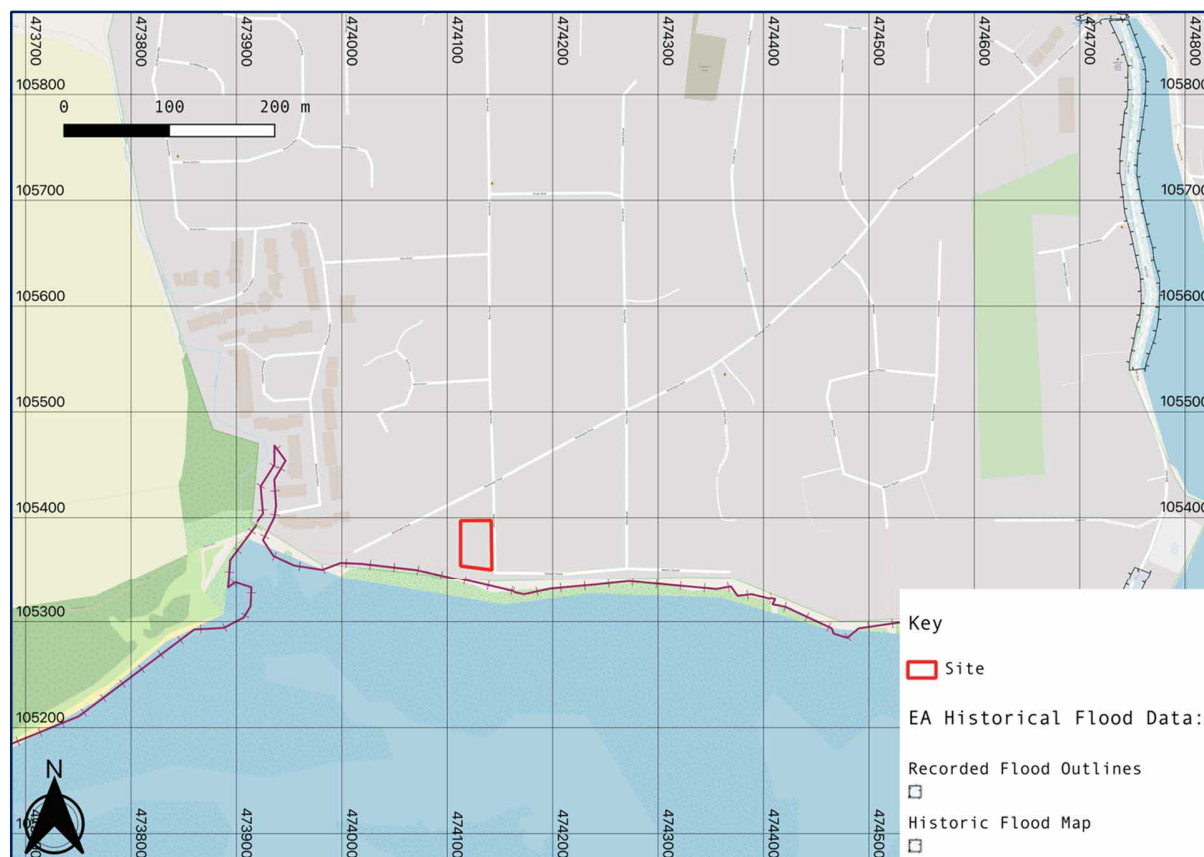


Figure 7: EA Historic Flood Mapping (Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © <https://www.openstreetmap.org> and contributors. Contains public sector information licensed under the Open Government Licence v3.0)

Pluvial Flood Risk

- 4.27. Pluvial flooding can occur during prolonged or intense storm events when the infiltration potential of soils, or the capacity of drainage infrastructure is overwhelmed leading to the accumulation of surface water and the generation of overland flow routes.
- 4.28. Examination of EA surface water flood risk mapping shows the site is not impacted by the modelled 3.3% (high risk), 1% (medium risk) or 0.1% (low risk) AEP flood events and is therefore at a 'Very Low' risk from surface water flooding, as evident in Figure 8.

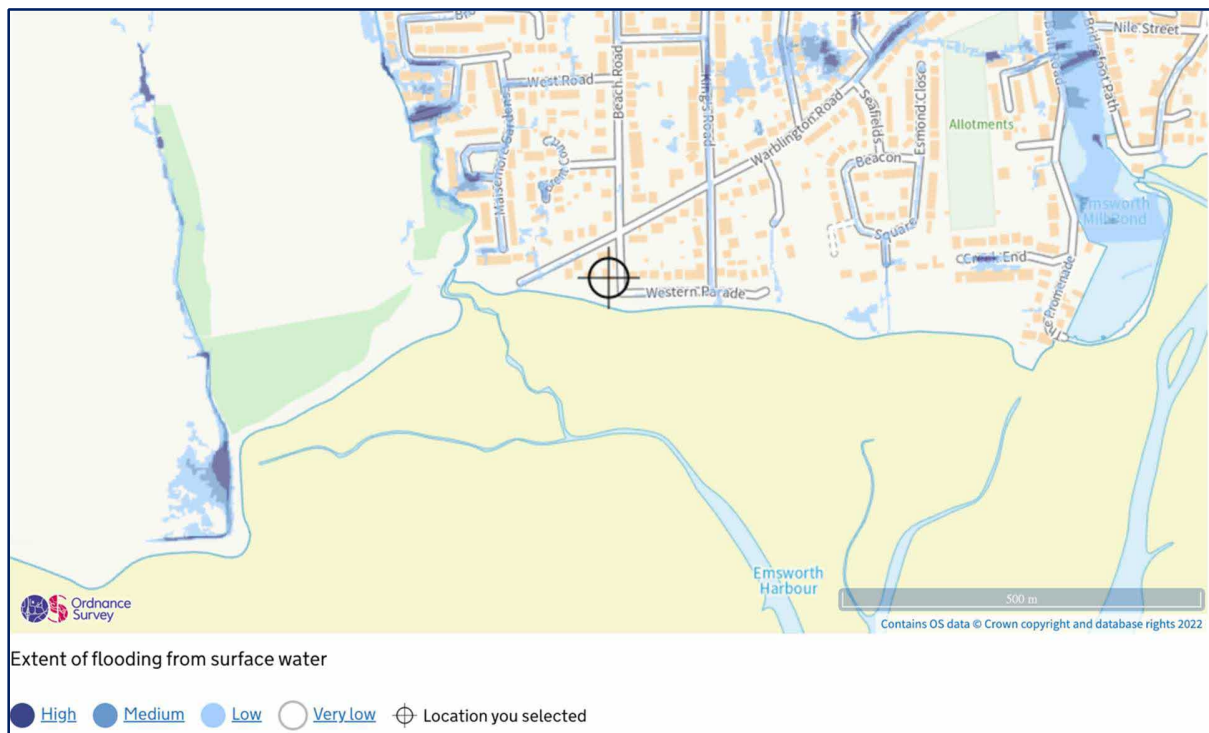


Figure 8: EA Surface Water Flood Risk Mapping

4.29. As such, the risk of flooding from pluvial sources is considered low.

Reservoirs

4.30. As demonstrated in the EA flood risk from reservoirs mapping (Figure 9) the site is outside flood extents in the event of reservoir flooding and is therefore at low risk from this source.

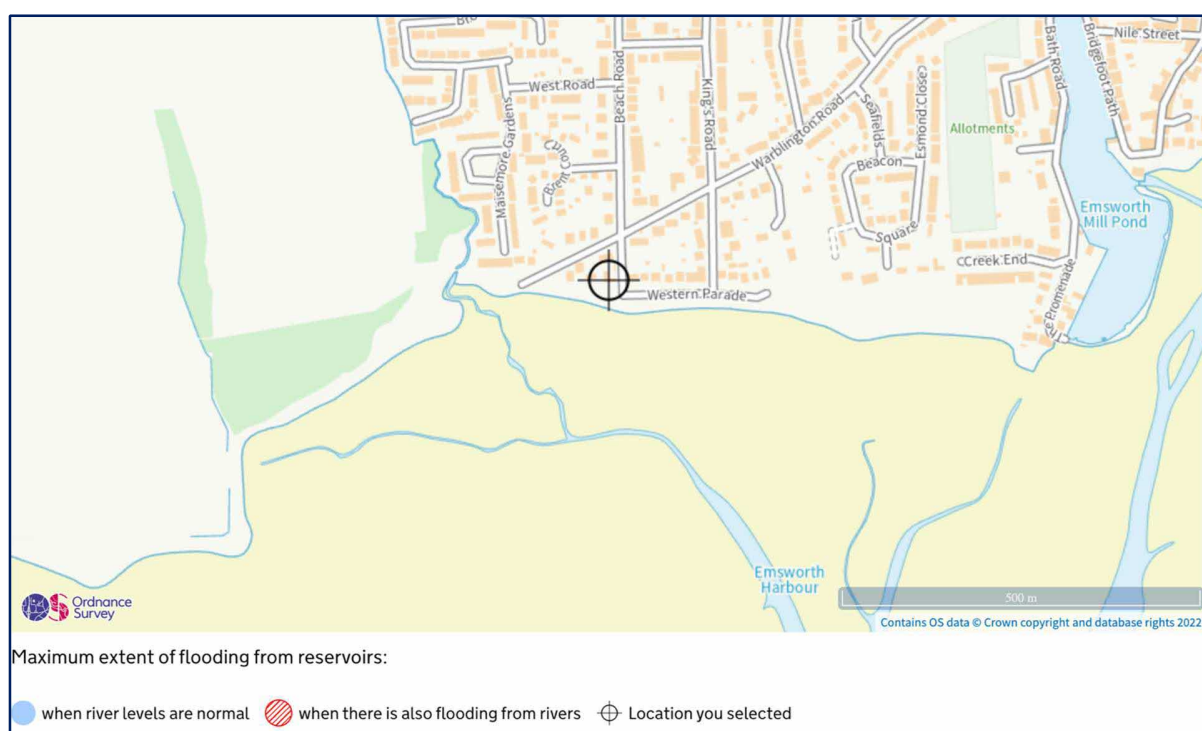


Figure 9: EA Reservoir Flood Risk Mapping

Groundwater

- 4.31. Groundwater flooding occurs in areas where underlying geology is permeable and water can rise within the strata sufficiently to breach the surface.
- 4.32. The British Geological Survey's (BGS) mapping shows superficial deposits of River Terrace Deposits comprising sand, silt, and clay underlying the site (Figure 10).

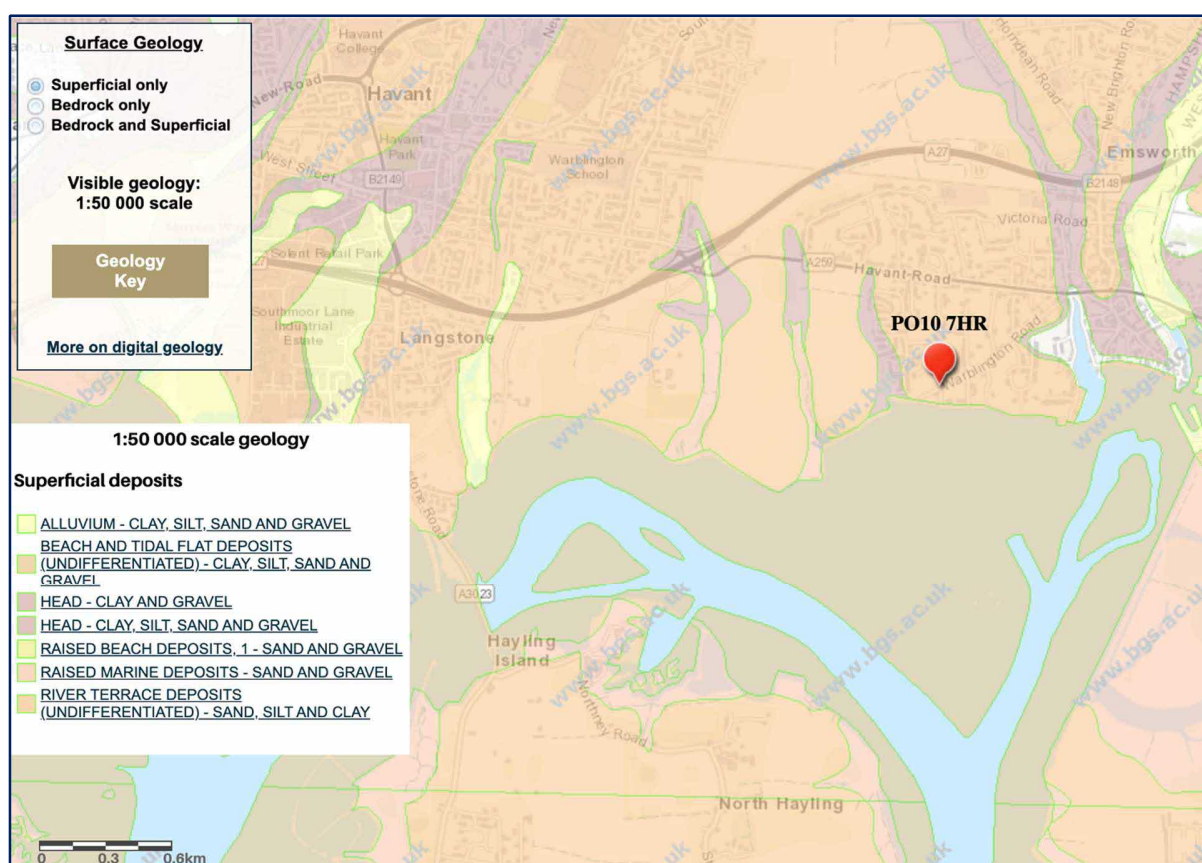


Figure 10 BGS Superficial Deposits (Source: BGS, 2022)

4.33. The bedrock underlying the site is Lewes Nodular, Seaford, Newhaven, Culver And Portsdown Chalk Formation - Chalk. (Figure 11).

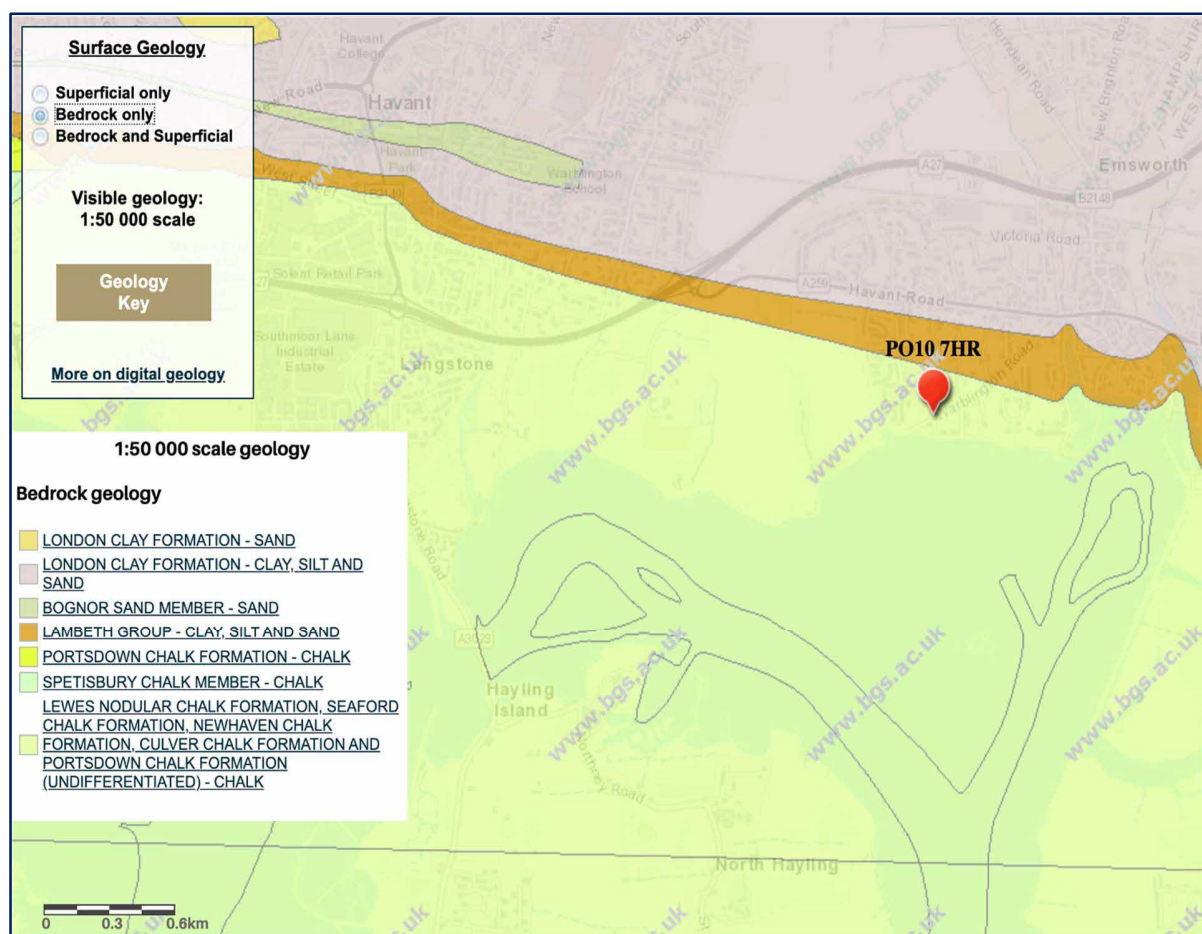


Figure 11 BGS Bedrock Geology (Source: BGS, 2022)

4.34. The PUSH SFRA provides online mapping which shows the site to be within an area of high bedrock permeability, shown in Figure 12.

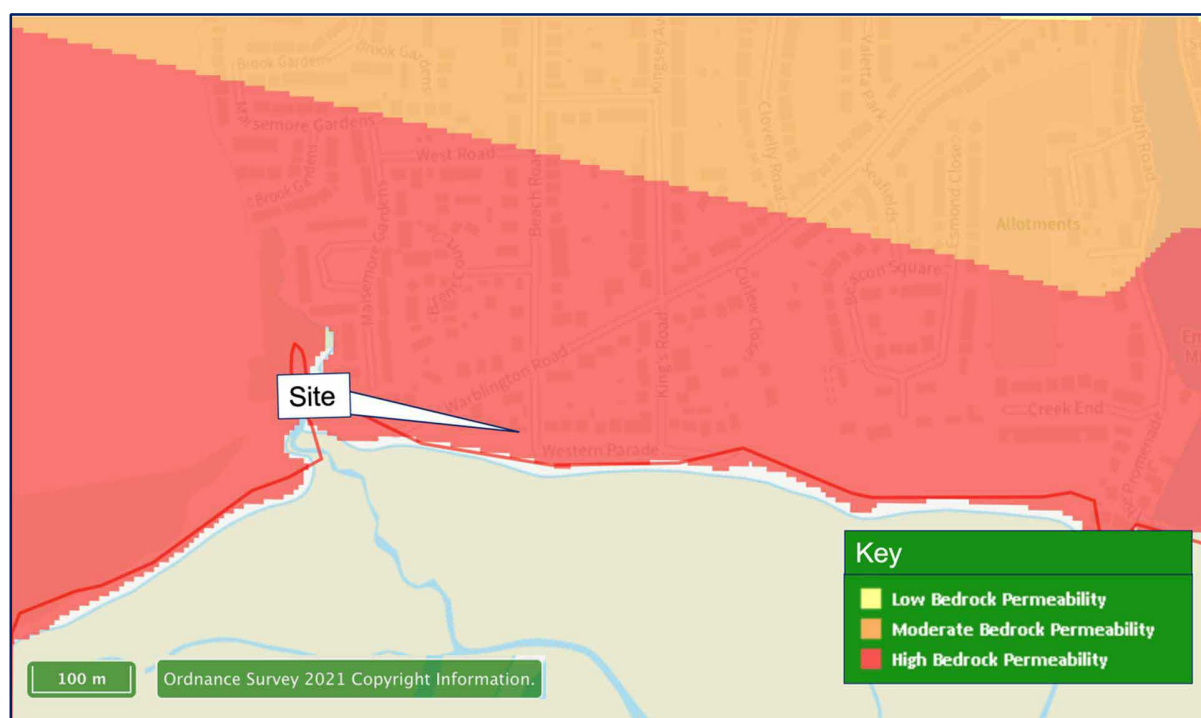


Figure 12 PUSH SFRA Bedrock Permeability Mapping

- 4.35. The PUSH SFRA Groundwater Incident mapping details the closest groundwater flood incident to be approximately 2.7km north-west of the site.
- 4.36. As the development proposals do not include any proposed basements, nor could any record of groundwater flooding be found in the vicinity of the site, the risk from groundwater to the development is considered to be moderate.

Sewer Flooding

- 4.37. No historical sewer surcharging incidents have been recorded in the vicinity of the site and local policy documentation does not identify the site as being located within a Critical Drainage Area.
- 4.38. The development is therefore considered to be at low risk of flooding from sewers.

5. Flood Risk Mitigation

Tidal

- 5.1. The site is partially located within Tidal Flood Zones 2 and 3.
- 5.2. The proposed FFL of the house will be 600mm above the existing, at 4.86m AOD, whilst the proposed garage FFL will remain at 4.56m AOD.
- 5.3. Based on the analysis within this report, the proposed garage could experience flood depths of 0.9m in the 1:200 year +CC (Upper End) event while in the same event, the proposed dwelling could experience flood depths of 0.6m.
- 5.4. As such, the risk of tidal flooding to the proposed development in the present day, is considered low, however, when considering the impact of climate change, the risk of tidal flooding to the proposed development is considered high.
- 5.5. However, the proposal is for the construction of a replacement dwelling, and the FFLs of the house are being raised 600mm above the existing FFLs, thus providing a betterment compared to the existing situation.

Flood Resistance and Resilience

- 5.6. Given that the ground floor may be subject to flooding, and with the impacts of climate change, flood resilience measures are recommended to facilitate quick recovery following a flood event. The following measures are recommended where applicable and possible for the house:
 - Solid (i.e. concrete floors) with waterproof screed.
 - Raised wiring and power outlets at lower ground and ground level.
 - Waterproof plasterboard used at lower ground and ground floor.
 - Air brick covers to be installed.
 - Damp Proof Membranes (d.p.m.) should be included in any design to minimise the passage of water through ground floors.
 - Patio doors may be susceptible to ingress of flood water. Any PVC window/door sills should be adequately sealed. Double glazing should be used to provide resistance against external flood water pressure. Of concern would be excessive water pressure on the glazing of patio doors.
 - Non-return valves on any new sewer connection to prevent back flow.
 - All new plumbing insulation to be of closed cell design.
 - Site owners and residents required to sign up to the EA flood warning service (Langstone and Emsworth)

Safe Access and Egress

- 5.7. Safe access and egress is required to enable the evacuation of people from the site, provide emergency services with access to the development during time of flooding, and enable flood defence authorities to carry out any necessary duties during periods of flooding.
- 5.8. Analysis within this report has indicated that flood depths on Beach Road could exceed 250mm in the 1:200 year +CC calculated events and thus safe access/ egress may not be possible in these events. Prior evacuation is recommended upon receipt of a Flood Warning. If this is not possible, temporary refuge should be sought at the first floor above calculated flood levels until the tide recedes.

EA Flood Alert and Warning Service

- 5.9. As a further precaution and risk reduction, residents should sign up to the EA's Flood Alert and Warning Service (Langstone and Emsworth), available at: <https://www.gov.uk/sign-up-for-flood-warnings>.
- 5.10. This service allows site owners to register an address, which is at risk of flooding, along with contact details so that in the event of a flood being forecast, residents will be sent an alert directly and able to evacuate as necessary.
- 5.11. Flood warnings/alerts can be enforced at any time of the day or night. Signing up for this service provides site owners some notice before a flood event. The amount of time afforded before a flood occurs depends on the site specific location (e.g. proximity to the source of flooding, topography of the surrounding area) and the flood mechanism (e.g. bank over topping versus a breach event).
- 5.12. Flood alerts and warnings provide site owners with time to take necessary action, e.g. communication of the risk of flooding to occupants, evacuation of occupants offsite or to a safe level, removal of valuable items out of reach of flooding and the mounting of site specific flood defences.

Table 5 EA Flood Alert and Warning System

	<u>FLOOD ALERT</u> What it means? - o Flooding is possible, be prepared. When is it used? - o Two hours to two days in advance of flooding. Triggers - o Forecasts that indicate flooding from rivers may be likely. - o Forecasted intense rainfall for rivers that respond very rapidly. - o Forecast of high tides, surges, or hind winds. What to do? - o Prepare to act on your flood plan. - o Prepare a flood kit of essential items
---	--



FLOOD WARNING

- o Monitor local water levels, flood forecast, and weather conditions.
- o Call Floodline on 0345 988 1188 for up to date information

FLOOD WARNING

What it means?

- o Flooding is expected –immediate action is required.

When is it used?

- o Half an hour to one day in advance of flooding.

Triggers

- o High tides, and surges coupled with strong winds.
- o Heavy rainfall forecast to cause flash flooding of rivers.
- o Forecast flooding from rivers.

What to do?

- o Move people, pets, and valuables to a safe place.
- o Turn off gas, electricity and water supplies (if safe to do so).
- o Put flood protection equipment in place (if possible).
- o Call Floodline on 0345 988 1188 for up to date information.

SEVERE FLOOD WARNING

What it means?

- o Severe flooding with danger to life.

When is it used?

- o When flooding poses a significant threat to life or severe disruption to communities.

Triggers

- o Actual flooding where the conditions pose a significant risk to life and/or disruption to the community.
- o On site observations from flooded locations
- o A breach in defences or failure of a barrier that is likely to cause significant risk to life.
- o Discussions with partners.

What to do?

- o Stay in a safe place with a means of escape.
- o Prepare to evacuate from your home.
- o Co-operate with emergency services.



SEVERE FLOOD WARNING

- o Only when instructed to evacuate by Emergency Services, leave the property and follow the agreed evacuation plan.

Fluvial and Canals

- 5.13. The risk of pluvial and canal flooding to the proposed development is considered low and therefore no specific mitigation measures are recommended above those being implemented for tidal flooding.

Pluvial, Sewers and Reservoirs

- 5.14. Flood risk from pluvial, sewers and reservoirs is considered low and therefore no specific mitigation strategies are required.

Groundwater

- 5.15. The risk from groundwater to the development is considered to be moderate.
- 5.16. Therefore, if groundwater is encountered during construction, appropriate waterproofing measures should be implemented as part of the build.

Increase to Flood Risk Elsewhere

- 5.17. The site is within an area at risk of tidal flooding rather than fluvial, and thus any displacement of flood water and increase in flood risk elsewhere could be considered negligible.

6. Surface Water Drainage Strategy

Nearby Watercourses

- 6.1. There are no main rivers, ordinary watercourses or canals within the vicinity of the site, therefore, discharging surface water into a watercourse or waterbody is not feasible. It is understood that Southern Water sewers in the area discharge into the Nore Rithe (tidal water body on the south of Western Parade).

Ground Conditions

- 6.2. At the time of writing, no specific ground investigations have been carried out on site.
- 6.3. The British Geological Survey's (BGS) mapping shows superficial deposits of River Terrace Deposits comprised of sand, silt, and clay underlying the site (Figure 10). The bedrock underlying the site is Lewes Nodular, Seaford, Newhaven, Culver and Portsdown Chalk Formation - Chalk. (Figure 11). As can be seen from Figure 12, the site is with an area of high bedrock permeability.
- 6.4. Normally in such ground conditions, infiltration SuDS may be possible. However given the increased tidal flood risk over the lifetime of the proposed development there may be potential for increases groundwater over the lifetime, which could impact the performance of infiltration SuDS.
- 6.5. For the purpose of the report, it is assumed that infiltration techniques would not be a viable option for the disposal of surface water.
- 6.6. It is recommended that BRE 365 percolation testing is completed prior to the detailed design stage.

Existing Drainage Infrastructure

- 6.7. A topographical survey is included as Appendix B and an extract is reproduced as Figure 13. Figure 13 shows three manholes located to the north of the site as well as gullies and seven rainwater downpipes associated with the existing building.

- 6.8. It is recommended that a CCTV survey is obtained prior to the construction of any new drainage infrastructure to determine the nature and condition of the existing private drainage infrastructure and downstream network.
- 6.9. A Southern Water Asset Plan has been obtained (Appendix F). This shows a public surface water sewer and a public foul water sewer flowing beneath Beach Road. The asset plan indicates that the surface water sewer discharges into the Nore Rithe (tidal water body on the south of Western Parade) as per Figure 14. The existing site is presumed to drain to the existing surface water and foul water sewers (via private connections) at an unrestricted rate. Therefore, betterment will be provided by limiting runoff to the greenfield (Q_{bar}) rate.

- 6.10. It is presumed that there is an existing connection to the Southern Water sewer and this existing connection should be reused where possible.



Figure 14. Extract of Southern Water Asset Plan

Surface Water Drainage Strategy

- 6.11. In accordance with the SuDS Management train approach, the use of various SuDS measures to reduce and control surface water flows have been considered in detail for the development.
- 6.12. The management of surface water has been considered in respect to the SuDS hierarchy below, as detailed in the CIRIA 753 “The SuDS Manual” (section 3.2.3).

Table 6 SuDS Drainage Hierarchy

SUDS DRAINAGE HIERARCHY				
			Suitability	Comment
	1.	Store rainwater for later use	}	There are plot-scale opportunities for rainwater harvesting measures such as water butts and these should be implemented where practical. A series of rainwater planters is proposed on site. Downpipes should be routed through rainwater planters and water butts with overflows to the proposed soakaways. The captured rainwater could be re-used for irrigation of the landscaping on site.
	2.	Use infiltration techniques, such as porous surfaces in non-clay areas	x	Infiltration testing has not been undertaken at the site. However, desktop geology investigations indicates that the ground conditions may be associated with high groundwater levels over the lifetime of the development given the potential increase in sea levels, so infiltration may not be possible. BRE 365 percolation testing should be undertaken prior to the detailed design stage.
	3.	Attenuate rainwater in ponds or open water features for gradual release	x	Space on site within the confines of the proposed layout and site slope does not allow for large above ground SuDS such as basins or ponds.
	4.	Attenuate rainwater by storing in tanks or sealed water features for gradual release	}	Has been deemed an appropriate option for attenuation.
	5.	Discharge rainwater direct to a watercourse	x	No watercourses within a feasible distance from the site.
	6.	Discharge rainwater to a surface water sewer/drain	}	Existing surface water drainage infrastructure is located on site. The existing public sewer connection is to be reused post-development, where possible. Any new connection subject to approval from Southern Water.
	7.	Discharge rainwater to Combined Sewer	x	No combined sewers within the vicinity of the site.

6.13. On review of the SuDS drainage hierarchy, and with reference to both national and local policy, it is proposed that the surface water runoff from the development is managed via type a porous paving and geocellular storage. Surface water runoff from the dwelling roof area will be attenuated in the geocellular storage, whilst the Type C porous paving will only provide attenuation for runoff in the area of proposed paving (the driveway).

6.14. Surface water from the rooftop will be conveyed into a series of bioretention planters for additional storage where rainwater can be harvested and reused when required. From the bioretention planters, surface water will be conveyed to the underground drainage network.

6.15. Surface water runoff from the proposed development is ultimately discharged to the public surface water sewer beneath Beach Road, at a controlled rate using an appropriate flow control device (hydrobrake restricting flows to 1l/s or a 25mm orifice plate limiting flows to approx. 0.8 - 1l/s).

6.16. The existing public sewer connection is to be reused post-development, where possible. Any new connection subject to approval from Southern Water.

6.17. The Surface Water Drainage Layout is included in this report as Appendix D.

Greenfield Runoff Rate

6.18. The total proposed impermeable area at the site is approximately 0.066ha.

6.19. The greenfield runoff rate (QBAR rural) was calculated in InfoDrainage (v2024) using the ICP SuDS methodology. For sites smaller than 50 ha, the IH124 method is applied to a 50 ha site and the results multiplied by a scale factor equal to the site area (in hectares) divided by 50. QBAR was calculated using the following formula (equation yields m³/s):

$$QBAR_{\text{rural}} = 0.00180 \times \text{AREA}^{0.89} \times \text{SAAR}^{1.17} \times \text{SOIL}^{2.17}$$

6.20. The greenfield runoff rate (Qbar) for the impermeable area of 0.066ha (excluding urban creep) was calculated as 0.2l/s.

6.21. It is not possible to design a flow control this small due to be significant increased risk of blockage. A hydrobrake limiting flow to a minimum of 1l/s or a 25mm orifice plate (which limits rates to approx. 0.8-1.0l/s) is generally the accepted practical minimum rate.

Brownfield Runoff Rate

6.22. InfoDrainage Software (v2024) was used to calculate the existing runoff rates from the development proposals area. It was assumed that the existing area is positively drained (1,097m²) to provide an indicative existing runoff rate.

6.23. Calculations indicate that during the present day 1 year, 30 year and 100 year events, the maximum outflow may be 7.2/s, 17.7l/s, and 22.5l/s, respectively (Table 7).

Table 7 Existing (Unrestricted) Runoff Rates

Catchment	Area	1 in 1 Year	1 in 30 Year	1 in 100 Year
Existing	750m ²	7.2l/s	17.7l/s	22.5l/s

Climate Change

6.24. The Environment Agency Peak Rainfall Climate Change Allowance guidance was reviewed and subsequently the Defra Peak Rainfall Allowances Map was assessed to determine appropriate climate change allowances to inform the surface water drainage strategy. The upper end allowances for the Arun and Western Streams Management Catchment have been used for both the 3.3% and 1% annual exceedance probability events for the 2070s epoch (40% and 45% respectively).

InfoDrainage Calculations

6.25. A network model has been produced in InfoDrainage software (v 2024.0).

6.26. The total proposed impermeable area was calculated to be 660m² (0.066ha). A global figure of 10% was added to allow for Urban Creep which meant the total area within the calculations was 726m² (0.073ha).

6.27. The model comprises;

- 2 no. contributing catchment areas across the proposed development area representing hardstanding surfaces for a total area of 0.072 ha. An additional 10% allowance for urban creep has been included in the calculations, this represents a conservative approach whereby an allowance is made for the conversion of permeable areas to impermeable areas over the lifetime of the development.
- 2 no. proposed surface water manholes
- 1 hydrobrake manhole restricting flows to a maximum of 1l/s
- 1 geocellular attenuation unit 10.0m (W) x 9.0m (L) x 0.5m (H), with 95% porosity
- 1 lined type a porous paving unit with a plan area of 200m² 0.15m height, and 30% porosity

6.28. The runoff from the dwelling roof has been applied as a point inflow into the manhole upstream of the proposed geocellular attenuation unit. Runoff from the driveway has been applied as a lateral inflow into the associated porous paving structure.

6.29. Table 8 summarises the simulation criteria for the InfoDrainage model.

Table 8 InfoDrainage Criteria

Catchment Area Simulation Parameters	
Rainfall Data	FSR
Total Area	0.073Ha (includes a 10% allowance for Urban Creep)
Return Periods	1, 30, 30+40% for climate change, 100, 100 +45% for Climate Change. Summer and Winter
Storm Durations	15, 30, 60, 120, 240, 360, 480, 960, 1440 minute
Volumetric Runoff Coefficient	0.9 (summer and winter storms)
Percentage Impervious	100%
Time of Concentration	5 minutes

6.30. The full calculation outputs can be found in Appendix E of this report although the 1 in 100 year+45% climate change results for the geocellular attenuation unit have been summarised below:

- o Flow rates into the public sewer were a maximum of 0.8l/s for the critical storm (1440mins Summer).

- o Depths in the 0.5m deep geocellular attenuation would reach 0.486m in the critical storm (480mins Winter).
 - o Depths within the 0.2m porous paving unit would reach 0.173m in the critical storm (240 mins Summer).
- 6.31. No flooding occurs within the model for either the geocellular attenuation or the porous paving unit. As such, these results indicate that the runoff from the proposed development could be accommodated within a drainage system of the approximate size modelled.

Water Quality

- 6.32. A key element of SuDS is that they have the potential to improve the quality of surface water discharged from a site. In order to assess this, the “Pollution hazard indices for different land use classifications”, provided in the CIRIA SuDS Manual (C753) as table 26.2, has been reviewed. The indices use four different methods of assessing pollution potential based on the hazard level, total suspended solids (TSS), Metals, and Hydrocarbons.
- 6.33. The Pollution Hazard Indices are summarised in Table 9 below (with reference to table 26.2 in the CIRIA SuDS manual). The pollution hazard indices for “residential roofs” and “low traffic roads” have been used.
- 6.34. Runoff from residential roofs is generally considered low contamination risk and does not usually warrant any significant treatment. All downpipes should be fitted with silt traps to reduce the amount of sediment entering the subsurface piped network.
- 6.35. However, treatment of runoff from the driveway will be required. A petrol interceptor should be installed at the downstream end of the proposed drainage system, to treat runoff prior to entering the existing downstream system.

Table 9. Pollutant Hazard Indices

Pollution Hazard Indices				
Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roofs	Low	0.3	0.2	0.05
Low Traffic Roads	Low	0.5	0.4	0.4

Table 10 Permeable Paving Mitigation Indices

Mitigation Indices			
Mitigation Measure	TSS	Metals	Hydrocarbons
Permeable Paving	0.7	0.6	0.7

Maintenance

- 6.36. Table 11 presents details regarding the maintenance requirements for the proposed SuDS included as part of the development, taken from the CIRIA C753 The SuDS manual. Each manufacturer will have bespoke requirements however the below should be used as a guide. All SuDS will be privately maintained.

Table 11. Specific SuDS Maintenance Requirements (Source: CIRIA SuDS Manual)

Maintenance Schedule	Required Action	Typical Frequency
Geocellular Storage		
Regular Maintenance	Inspect and identify any area that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually

	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial Actions	Repair/ rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/ check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required
Permeable Paving		
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than a sprayer	As required
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper structure by remedial sweeping	Every 10 to 15 years as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth –if required, take remedial action	Three-monthly, 48hr after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Designing for Exceedance

- 6.37. Exceedance events are those greater than the design rainfall event, i.e. greater than the 100 year rainfall event plus 45% increase for climate change.
- 6.38. Periods of exceedance occur when the rate of surface water runoff exceeds the drainage system capacity. Conveyance beneath ground cannot, generally, be economically or sustainably constructed to the scale required for the most extreme rainfall events. This may result, on occasion, in the surface water runoff exceeding the capacity of the drainage network, with excess water (exceedance flow) being conveyed above ground.
- 6.39. For situations where extreme rainfall intensity exceeds inlet capacities, or for extreme storm events exceeding the design flood event considered for drainage design, surface water would flow overland towards the east of the site, flowing overland towards the road where surface water will flow south away from the site. Exceedance flows should not ingress into any properties onsite.

7. Conclusions

- 7.1. This report has been undertaken with reference to the requirements of NPPF and Planning Practice Guidance with respect to the development at 41 Beach Road, Emsworth, Havant, PO10 7HR. It has been written to support a pre-application and has been prepared with due consideration to the nature of the proposed development to provide the appropriate level of detail.
- 7.2. The FRA supports the application and demonstrates that there is an acceptable level of flood risk to the site if the mitigation strategies recommended are implemented in the scheme. The development does not increase flood risk off site or to the wider area.

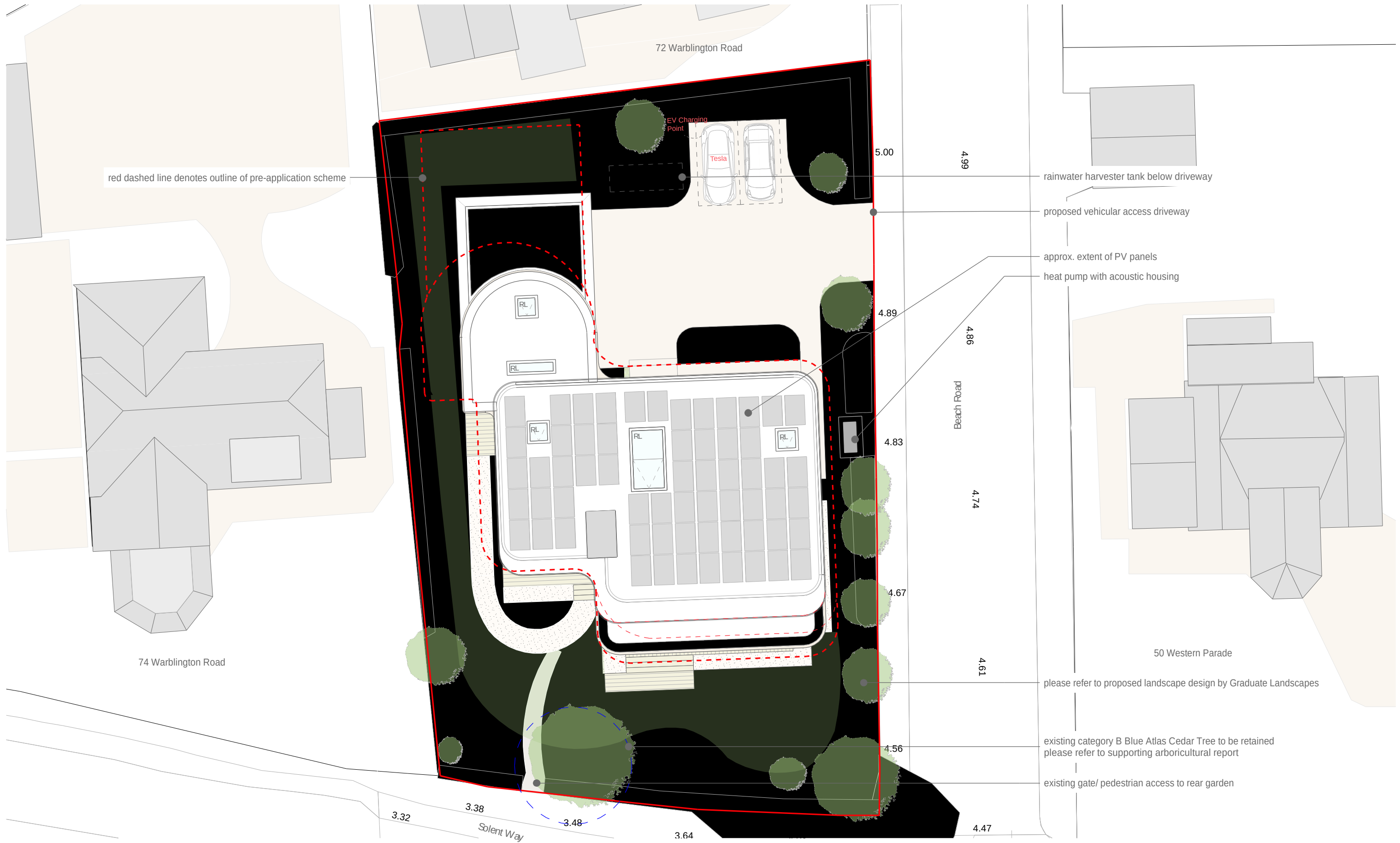
Source of Flooding	Flood Risk Summary
Tidal	The site is partially located within Flood Zones 2 and 3, denoting a medium and high risk of flooding from tidal sources. Based on the analysis within this report, the proposed garage could experience flood depths of 1.20m in the 1:200 year +CC (Upper End) event while in the same event, the proposed dwelling could experience flood depths of 0.6m. As such, the risk of tidal flooding to the proposed development in the present day, is considered low, however, when considering the impact of climate change, the risk of tidal flooding to the proposed development is considered high. However, the proposal is for the construction of a replacement dwelling, and the FFLs of the house are being raised above the existing FFLs, thus providing a betterment compared to the existing situation. Given that the ground floor may be subject to flooding in the 1:200 year event + CC, resilience measures should be implemented to facilitate quick recovery following a flood event. As a further precaution and risk reduction, the residents of the dwellings should sign up to the EA flood warning service (Langstone and Emsworth). The site should be evacuated as soon as a Flood Warning is issued.
Fluvial and Canals	The site is considered to be at low risk from these sources.
Pluvial, Sewers and Reservoirs	The site is considered to be at low risk from these sources.
Groundwater	The site is considered to be at moderate risk from groundwater flooding.

- 7.3. The following conclusions can be drawn from this level 1 FRA:

- The site could flood in the calculated 1:200 (0.5% AEP) year + CC tidal event.

- o The proposed garage could experience flood depths of 0.9m in the 1:200 year +CC (Upper End) event while in the same event, the proposed dwelling could experience flood depths of 0.6m.
 - The risk of fluvial and canal flooding is considered low.
 - The risk from pluvial, sewers and reservoirs is considered low.
 - The risk from groundwater is considered to be moderate.
 - The proposed development should not increase flood risk elsewhere through displacement of flood water.
 - Flood resilience measures are highly recommended to facilitate quick recovery following a flood event
 - The residents of the site should sign up to the EA flood warning service (Langstone and Emsworth).
- 7.4. The proposed drainage strategy is to discharge surface water to the Southern Water surface water sewer beneath Beach Road to the east of the site. The total peak flow rate leaving the site will be 0.7l/s, as the Q_{BAR} rate for the 0.066ha impermeable area would increase the risk of blockage. Excess flows from the outfalls will back up into the geocellular storage features prior to being gradually released.
- 7.5. The full calculation outputs can be found in Appendix E of this report although the 1 in 100 year +45% climate change results have been summarised below:
- o Flow rates into the public sewer were a maximum of 0.8l/s for the critical storm (1440mins Summer).
 - o Depths in the 0.5m deep geocellular attenuation would reach 0.486m in the critical storm (480mins Winter).
 - o Depths within the 0.2m porous paving unit would reach 0.173m in the critical storm (240 mins Summer).
- 7.6. This Flood Risk Assessment and drainage strategy should be submitted as part of the planning application to satisfy the requirements under NPPF.

Appendix A - Development Proposals



1:200
Site Plan Proposed



Scale @ A3: 1:200



NOTE: This drawing is to be scaled for planning purposes only

Project: Beach Road
Address: Beach Road,
Emsworth, PO10 7HR
Client: Mr M. Hughes

Drawing: Site Plan Proposed

387 - OBA - 00 - ZZ - DR - A - 0101 - P04

Status: PLANNING OBA proj no: 387

P04	Design Update	05/05/2023
P03	Design Update	14/04/2023
P02	Revised Design	17/02/2023
P01	Revised Design	08/02/2023
PA 01	Pre App	15/08/2022
rev	description	date

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1:200
Ground Floor GA Plan Proposed



Scale @ A3: 1:200



NOTE: This drawing is to be scaled for planning purposes only

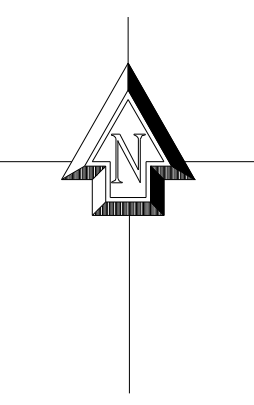
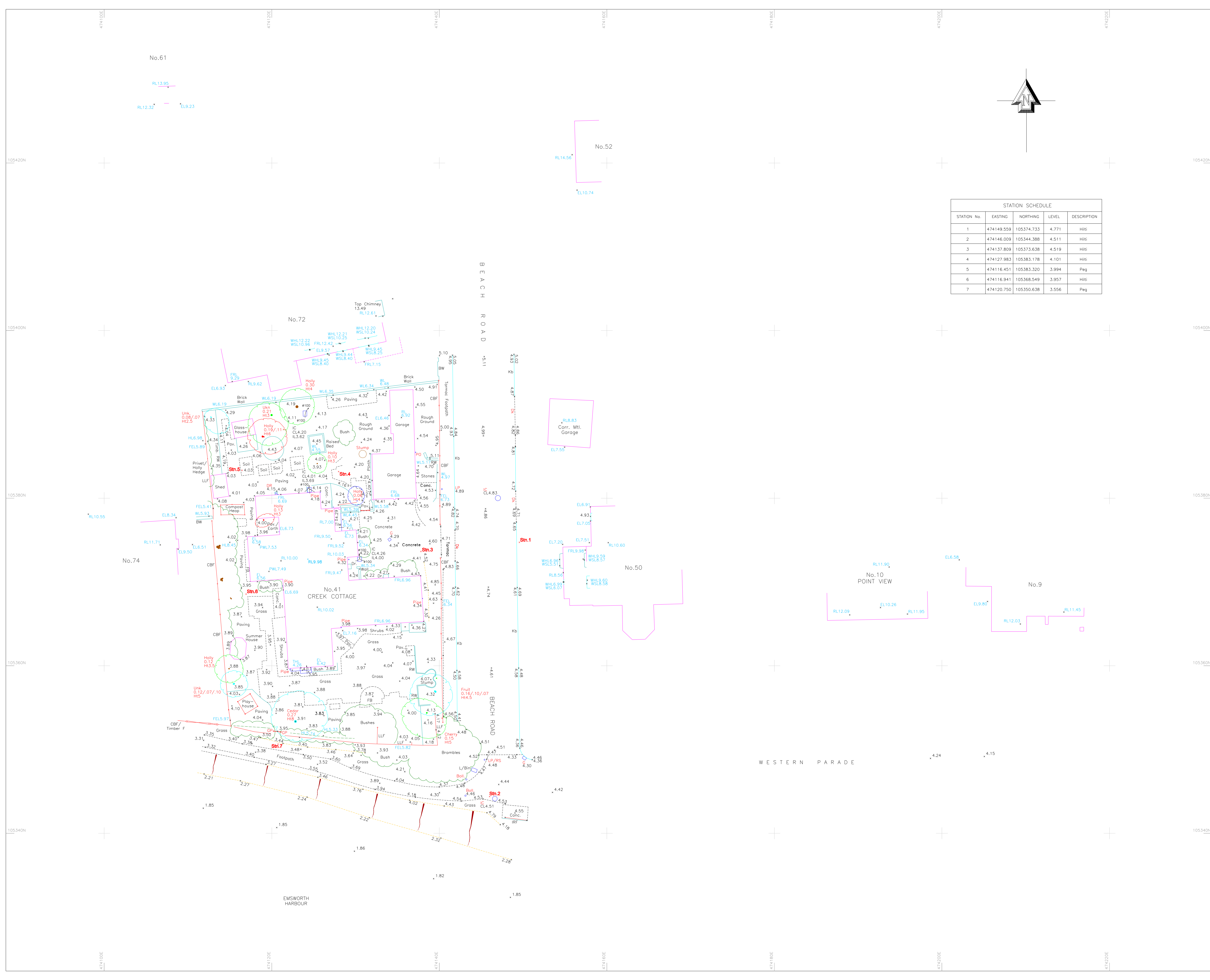
Project: Beach Road
Address: Beach Road,
Emsworth, PO10 7HR
Client: Mr M. Hughes

Drawing: Ground Floor GA Plan Proposed
387 - OBA - 00 - ZZ - DR - A - 0102 - P05
Status: PRELIMINARY OBA proj no: 387

P05	Design Update	14/ 04/ 2023
P04	Revised Design - PH	27/ 02/ 2023
P03	Revised Design	17/ 02/ 2023
P02	Revised Design	13/ 02/ 2023
P01	Revised Design	08/ 02/ 2023
PA01	Pre App	15/ 08/ 2022
rev	description	date

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Appendix B –Topographical Survey



STATION SCHEDULE			
STATION No.	EASTING	NORTHING	LEVEL
1	474149.559	105374.733	4.771
2	474146.009	105344.388	4.511
3	474137.809	105373.638	4.519
4	474127.983	105383.178	4.101
5	474116.451	105383.320	3.994
6	474116.941	105368.549	3.957
7	474120.750	105350.638	3.556

Legend			
AV	Air Valve	L/Bin	Litter Bin
BEB	Bellish Beacon	LB	Litter Box
BH	Borehole	LP	Lamp Post
BL	Bed Level	M/Bole	Multiple Bole
BO	Bollard	Mem	Statue/Memorial
BRS	Brick Setts	MK	Marker
BS	Bus Stop	MS	Milestone
CATV	Cable TV Cover	NB	Notice Board
CB	Control Box	OHC	Overhead Cable
CCTV	Surveillance Camera	OSBM	Bench Mark
CH	Channel	Pav	Paving
CL	Cover Level	PI	Pillar
Cob	Cobbles	PM	Parking Meter
Col	Column	PO	Post
Conc	Concrete	PWL	Parapet Wall Level
Cul	Culvert	RE	Rodding Eye
Cyc	Cycle Rack	RG	Rough Ground
DA	Drop Away	RL	Ridge Level
Dk	Drop Kerb	RTL	Road Line
DR	Drain	RN	Road Nail
DP	Down Pipe	RNB	Road Name Board
EL	Eave Level	RP	Reflector Post
ELC	Electricity IC	RS	Road Sign
EP	Electricity Pole	RWP	Rain Water Pipe
ER	Earth Rod	Sap	Sapling
FB	Flower Bed	Shr	Shrub
Fd	Foundations	SL	Sump Level
FEL	Fence Level	Spk	Spok
FH	Fire Hydrant	Stp	Step
FL	Floor Level	STW	Stay Wire
FP	Flag Pole	SV	Stop Valve
FLT	Floodlights	TacP	Tactile Paving
FRL	Flat Roof Level	TGB	Telephone Call Box
G	Gully	THL	Threshold Level
Gh	Glass House	TIC	Telecom IC
GP	Gate Post	TK	Tank
GV	Gas Valve	Tm	Ticket Machine
HL	Hedge Level	TL	Traffic Light
HT	Height	Tm	Tarmac
IC	Inspection Cover	TP	Telegraph Pole
IL	Invert Level	Tr	Tree
IRV	Irrigation Valve	UTL	Unable To Lift
JB	Junction Box	VP	Vent Pipe
Kb	Kerb	WL	Wall Level
KO	Kerb Outlet	WM	Water Meter
e	Diameter	WtrL	Water Level

Boundary Descriptions			
Fence Details			
Barr	Barrier	Int.F	Interwoven
BWF	Barbed Wire	LLF	Larch Lap
CBF	Close Board	P	Post
CF	Concrete Fence	PCF	Post & Chain
CF	Corrugated Iron	PWF	Post & Rail
CLF	Chain Link	PWF	Post & Wire
CPF	Chestnut Paling	PWM	Post & Wire Mesh
RF	Iron Railings	—	—
Wall Details			
BRW	Brick and Flint Wall	Drance	Drance Survey Bench Mark
BRW	Black Wall	—	—
BW	Brick Wall	—	—
CW	Concrete Wall	—	—
FW	Flint Wall	—	—
RLW	Retaining Wall	—	—
SLM	Sloping Masonry	—	—
W	Wall	—	—
All underground service information should be checked prior to any works taking place. The type, size and route of all drainage has been ascertained by visual inspection only. An arboriculturist must be contacted to verify tree species and descriptions if necessary.			

JUNE 22	B	Drawing amended
JUNE 22	A	Drawing amended
DATE	REVISIONS	

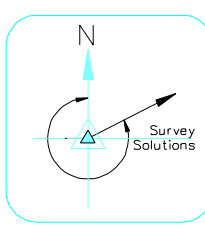
HAMPSHIRE LAND SURVEYS LTD
Land, Building and Engineering Surveys

Mobile 07563 677394
E-Mail hampls@aol.com
www.hlsld.co.uk

CLIENT
Amberleigh House Ltd
Deale House
16 Lavant Street
Petersfield
Hampshire GU32 3EW

PROJECT No. HLS 2278

TITLE
CREEK COTTAGE
BEACH ROAD
EMSWORTH
Site Survey Existing



SCALE 1:200
DATE MARCH 2022

DRAWN KLB
CHECKED DB

DRG No. 2278_22_03_01
REV. B

Appendix C –Environment Agency Product 4 Information

Levels Map Centred on Beach Road, PO10 7HR - Created 7 June 2022



Legend

- E** Location_Point
- Water Depth**
- Value
- High : 27.561
 - Low : 8.34733e-006
- Ground Level**
- Value
- High : 18.1244
 - Low : -23.2942

1:500 *

*when printed at A4.

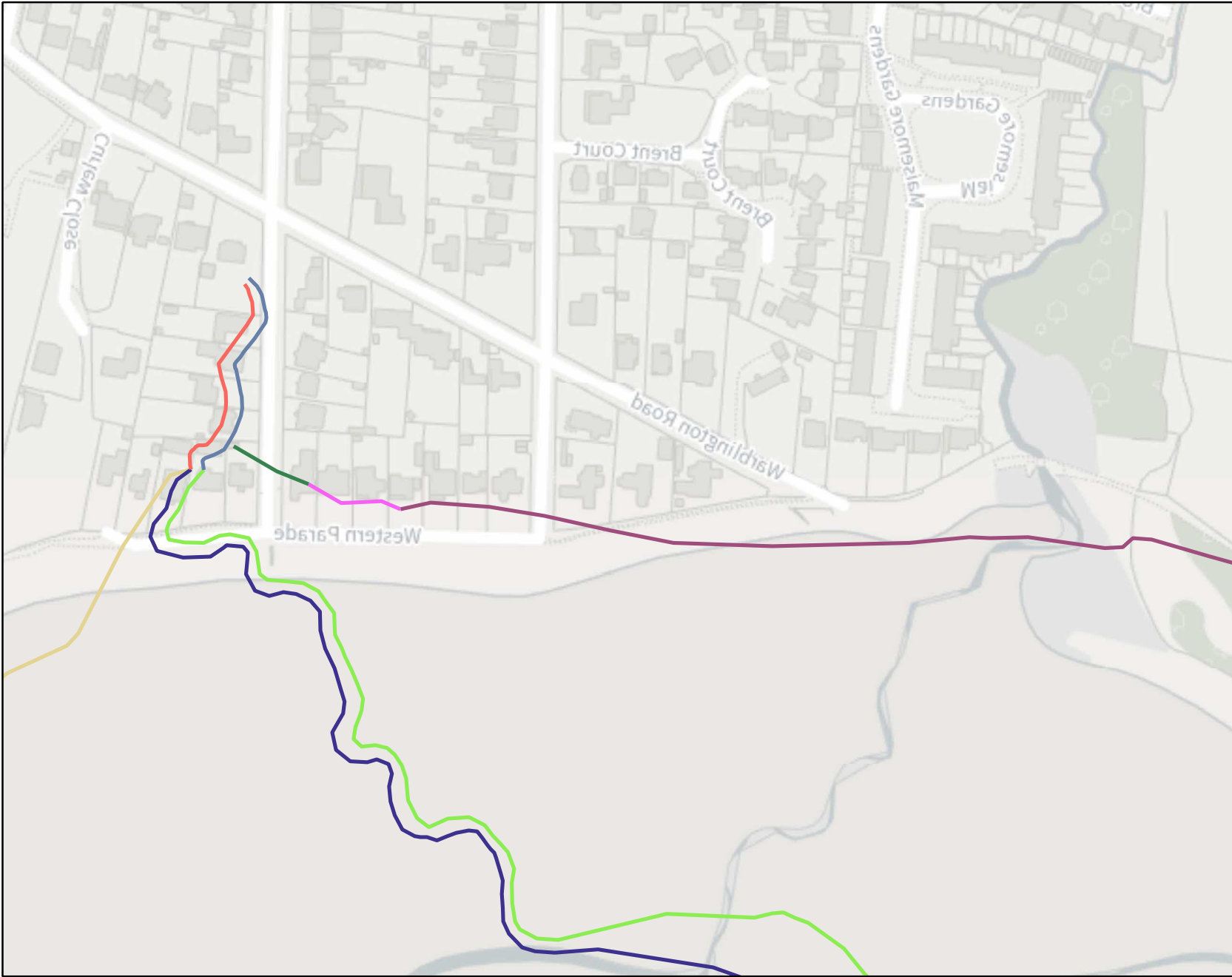
0 10 20

Metres

Water Depths & Levels for Beach Road, PO10 7HR

Point	Water Surface Level (mAOD*)				Ground Level	Water Depth (metres)			
	0.5% Annual Probability/ 1 in 200 Year (2065)	0.5% Annual Probability/ 1 in 200 Year (2115)	0.1% Annual Probability/ 1 in 1000 Year (2065)	0.1% Annual Probability/ 1 in 1000 Year (2115)		0.5% Annual Probability/ 1 in 200 Year (2065)	0.5% Annual Probability/ 1 in 200 Year (2115)	0.1% Annual Probability/ 1 in 1000 Year (2065)	0.1% Annual Probability/ 1 in 1000 Year (2115)
1	No Data	4.26	No Data	4.38	4.06	No Data	0.20	No Data	0.32
2	3.83	4.21	3.95	4.37	3.81	0.02	0.40	0.14	0.56
3	3.90	4.21	3.96	4.37	3.83	0.07	0.38	0.13	0.54
4	4.04	4.21	4.05	4.38	3.95	0.09	0.26	0.10	0.43
5	4.04	4.21	4.05	4.38	4.00	0.04	0.21	0.05	0.38
6	No Data	4.21	No Data	4.38	4.08	No Data	0.13	No Data	0.30
7	No Data	4.22	No Data	4.38	4.11	No Data	0.11	No Data	0.27
8	No Data	4.21	No Data	4.38	4.14	No Data	0.07	No Data	0.24
9	No Data	4.21	No Data	4.38	4.12	No Data	0.09	No Data	0.26
10	No Data	No Data	No Data	4.45	4.43	No Data	No Data	No Data	0.02

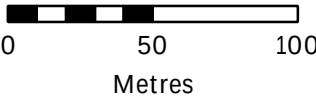
* Levels in metres above Ordnance Datum Newlyn



Legend

- asset_id
- 107645
 - 454771
 - 454891
 - 464353
 - 464354
 - 85451
 - 85488
 - 85489

1:2,612 *
*when printed at A4.



Asset ID	Asset sub-type	Length	Maintainer	Current condition	Design Standard of Protection (Years)	Date of last inspection
107645	Natural High Ground	1328.42	Unknown	No Data	1	30/05/2022
454771	Engineered High Ground	619.58	Unknown	No Data	No Data	04/10/2021
454891	Engineered High Ground	46.05	Unknown	No Data	No Data	04/10/2021
464353	Engineered High Ground	39.37	Unknown	No Data	No Data	04/10/2021
464354	Engineered High Ground	183.02	Unknown	No Data	No Data	04/10/2021
85451	Natural High Ground	1370.13	Unknown	No Data	1	30/05/2022
85488	Natural High Ground	105.35	Private individual, Company or Charity	No Data	2	30/05/2022
85489	Natural High Ground	100.90	Private individual, Company or Charity	No Data	2	30/05/2022

Flood Map for Planning (Rivers and Sea) - Centred on Beach Road, PO10 7HR - Created 7 June 2022



1: 10,000

0 Metres 250



Flood Map for Planning (Rivers & Sea)

- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.



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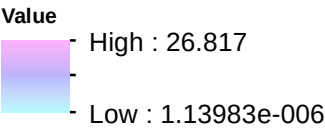
Levels Map Centred on Beach Road, PO10 7HR - Created 7 June 2022



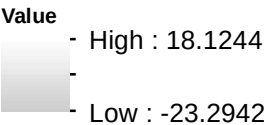
Legend

E Location_Point

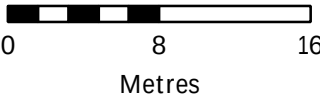
Water Depth



Ground Level



1:400 *
*when printed at A4.



Water Depths & Levels for Beach Road, PO10 7HR

Point	Water Surface Level (mAOD*)		Ground Level	Water Depth (metres)	
	0.5% Annual Probability/1 in 200 Year Present Day (Flood Zone 3)	0.1% Annual Probability/1 in 1000 Year Present Day (Flood Zone 2)		0.5% Annual Probability/1 in 200 Year Present Day (Flood Zone 3)	0.1% Annual Probability/1 in 1000 Year Present Day (Flood Zone 2)
1	No Data	4.07	4.06	No Data	0.01
2	3.82	3.84	3.81	0.01	0.03
3	3.87	3.88	3.83	0.04	0.05
4	4.04	4.05	3.95	0.09	0.10
5	4.04	4.05	4.00	0.04	0.05

* Levels in metres above Ordnance Datum Newlyn



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Use of Environment Agency Information for Flood Risk Assessments

Important

The Environment Agency are keen to work with partners to enable development which is resilient to flooding for its lifetime and provides wider benefits to communities. If you have requested this information to help inform a development proposal, then we recommend engaging with us as early as possible by using the pre-application form available from our website:

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

We recognise the value of early engagement in development planning decisions. This allows complex issues to be discussed, innovative solutions to be developed that both enables new development and protects existing communities. Such engagement can often avoid delays in the planning process following planning application submission, by reaching agreements up-front. We offer a charged pre-application advice service for applicants who wish to discuss a development proposal.

We can also provide a preliminary opinion for free which will identify environmental constraints related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In preparing your planning application submission, you should refer to the Environment Agency's Flood Risk Standing Advice and the Planning Practice Guidance for information about what flood risk assessment is needed for new development in the different Flood Zones. This information can be accessed via:

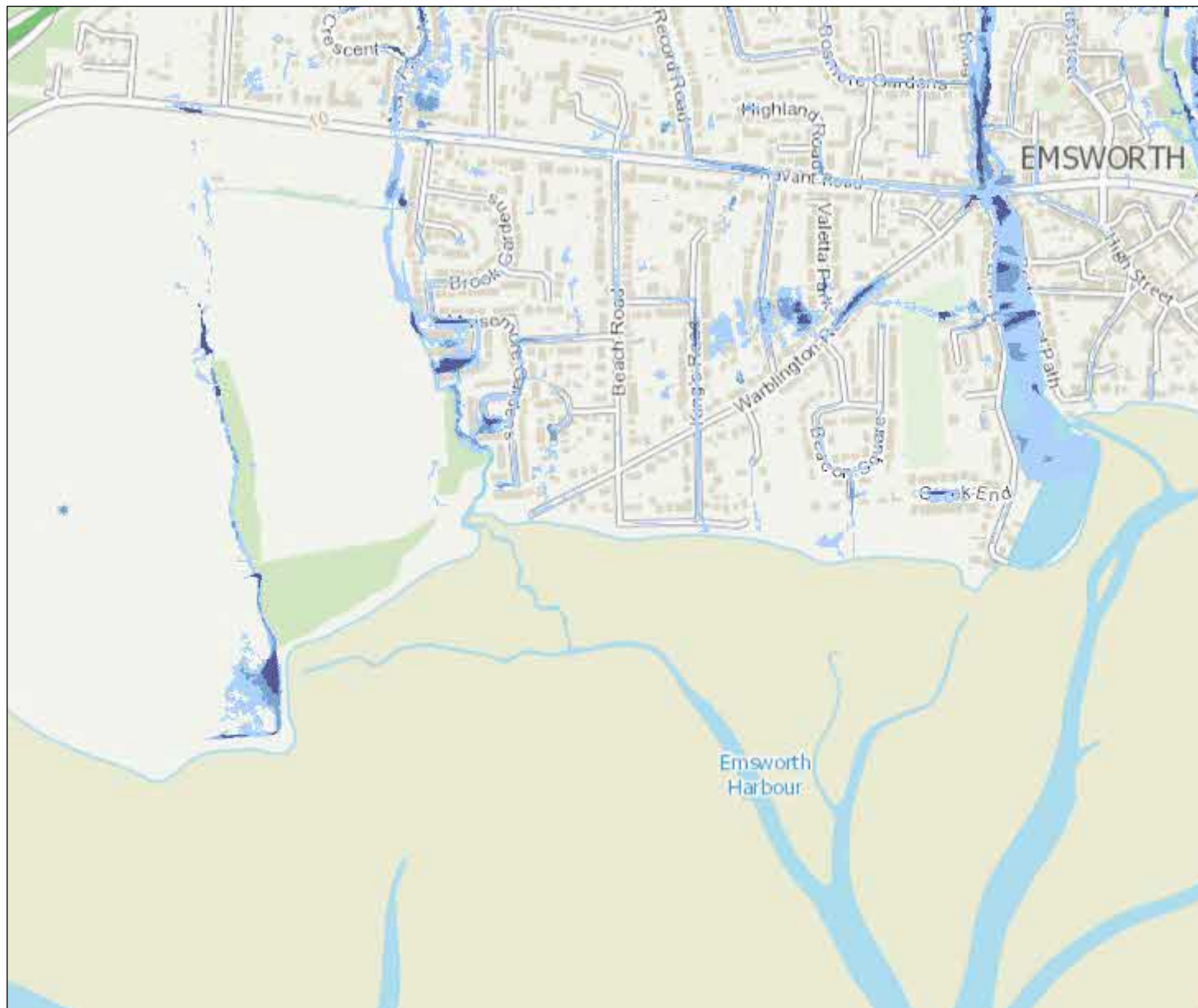
<https://www.gov.uk/flood-risk-assessment-standing-advice>
<http://planningguidance.planningportal.gov.uk/>

You should also consult the Strategic Flood Risk Assessment or other relevant materials produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment (FRA) where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or surface water runoff. Information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires an FRA and this is not submitted or is deficient, the Environment Agency may raise an objection.

Risk of flooding from Surface Water - Centred on Beach Road, PO10 7HR - Created 7 June 2022



1: 10,000

0 Metres 250



Likelihood of flooding from Surface Water

- High ($\geq 3.3\%$)
- Medium (3.3% - 1%)
- Low (1% - 0.1%)
- Very Low

Likelihood of flooding from Surface Water

- High: Greater than or equal to 3.3% (1 in 30) chance in any given year
- Medium: Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
- Low: Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
- Very Low: Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on GOV.UK.

Appendix D –Surface Water Drainage Layout

LINED POROUS PAVING - TO ACT AS A CONVEYANCE FEATURE WITH SURFACE WATER DISCHARGING INTO THE UNDERGROUND DRAINAGE NETWORK ON SITE

PLAN AREA - 200m²
POROSITY - 30%
DEPTH - 0.2m
BASE INFILTRATION

GEOCELLULAR CRATE

TOTAL CRATE DIMINTIONS 10.0m (l) x 9.0m (w) x 0.5m (h)

COVER LEVEL - 4.700
INVERT LEVEL - 3.700
COVER DEPTH - 0.5m

LOCATED 2.5m FROM ANY BUILDING AND ANY SITE BOUNDARY

CRATE IS TO BE WRAPPED IN AN IMPERMEABLE GEOMEMBRANE AS NO INFILTRATION IS PROPOSED

ANY EXISTING CONNECTION TO THE PUBLIC SURFACE WATER SEWER SHOULD BE REUSED WHERE POSSIBLE, BUT IF A NEW CONNECTION IS REQUIRED, THIS WILL BE SUBJECT TO SOUTHERN WATERS APPROVAL.

INVERT LEVEL OF CONNECTION TBC AND THE SYSTEM MAY BE REVISED TO ACCOUNT FOR FINAL INVERT LEVEL

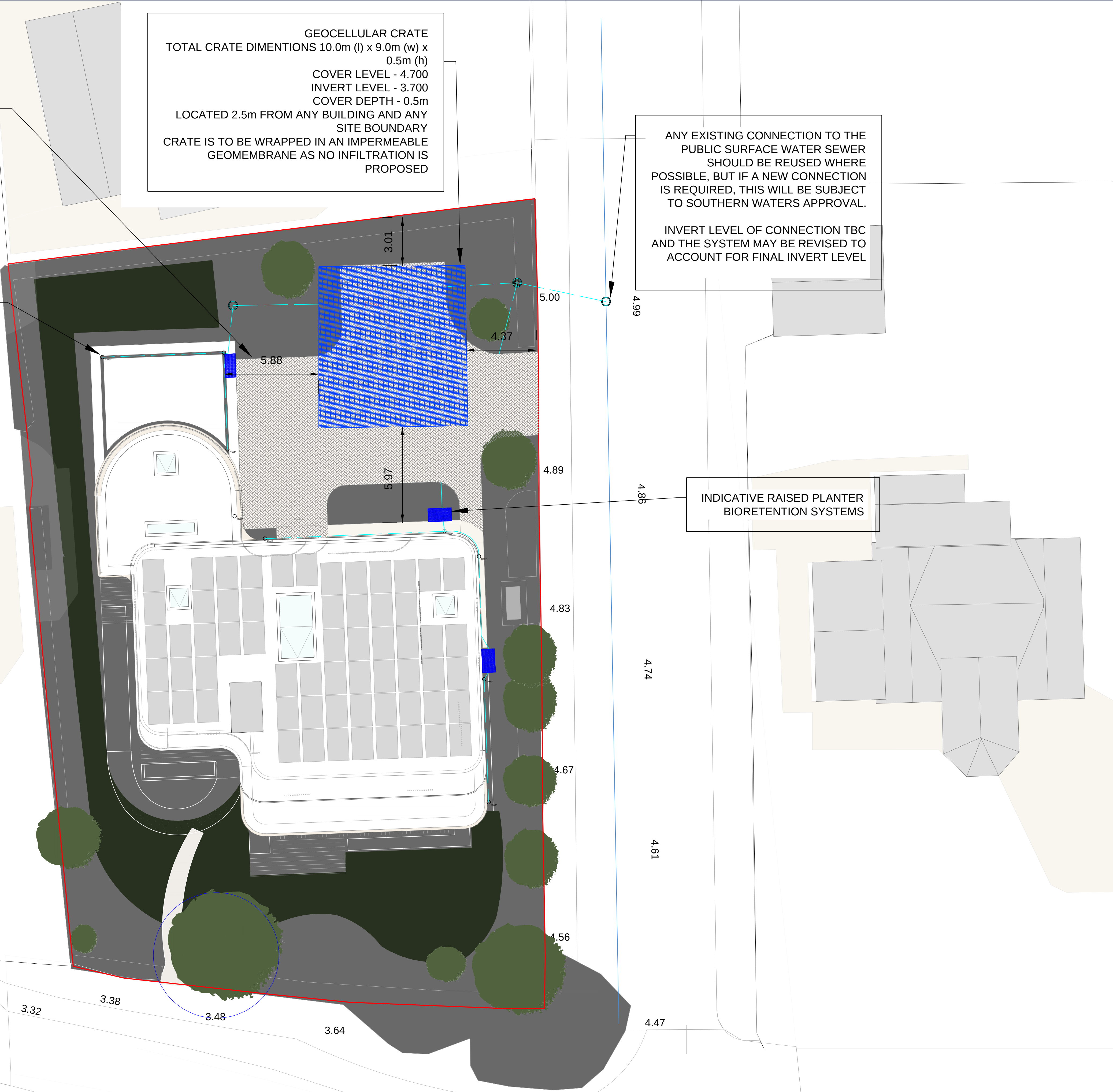
RAINWATER PIPE LOCATION SHOWN INDICATIVELY. RUNOFF SHOULD BE CONVEYED THROUGH PLANTERS/WATER BUTTS TO PROVIDE ADDITIONAL STORAGE WITH OVERFLOW INTO BELOW GROUND SYSTEM TO ATTENUATION TANK

NOTES

ALL LEVELS ARE TO METRES ABOVE ORDNANCE DATUM (AOD) UNLESS OTHERWISE SPECIFIED

GROUND LEVELS BASED ON TOPOGRAPHIC SURVEY

ANY NEW CONNECTIONS TO PUBLIC SEWERAGE INFRASTRUCTURE SUBJECT TO APPROVAL FROM THAMES WATER AND LLFA. IL OF CONNECTION SHOULD BE CONFIRMED PRIOR TO DETAILED DESIGN



- NOTES:**
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT REPORTS, PLANS AND ARCHITECTURAL DRAWINGS
 2. THIS DRAWING SHOULD NOT BE SCALED. THERE SHOULD BE NO RELIANCE ON THIS DRAWING WITH REGARDS TO DIMENSIONS. ALL DIMENSIONS SHOULD BE CONFIRMED ON SITE.
 3. ANY DISCREPANCY ON THIS DRAWING SHOULD BE REPORTED TO AEGAEA IMMEDIATELY FOR CLARIFICATION.
 4. THE CONTRACTOR IS RESPONSIBLE FOR ALL WORKS AND FOR THE STABILITY, INSTALLATION AND HEALTH AND SAFETY OF THE WORKS.
 5. AEGAEA HAVE PRODUCED THIS DRAWING BASED ON THE DRAWINGS AND INFORMATION PROVIDED BY THE CLIENT AVAILABLE AT THE TIME OF PRODUCTION. WE CANNOT ACCEPT RESPONSIBILITY FOR DISCREPANCIES RESULTING FROM NEW PLANS/ INFORMATION BEING ISSUED POST-ISSUE OF THIS DRAWING. THE CONTRACTOR SHOULD REVIEW THIS DRAWING IN LIGHT OF WIDER SITE INFORMATION SUCH AS CONTAMINATION, UTILITIES SURVEYS AND SITE INVESTIGATIONS
 6. IT IS THE RESPONSIBILITY OF THE PRINCIPLE CONTRACTOR TO MAKE THE DESIGNER AND CLIENT AWARE OF SITE-SPECIFIC RISKS AND HAZARDS THAT MAY AFFECT THE DRAWING AND SPECIFICATION

LEGEND

- PUBLIC SURFACE WATER SEWER
- EXISTING SURFACE WATER DRAIN
- PROPOSED SURFACE WATER DRAIN
- PROPOSED SLOT DRAIN
- HYDROBRAKE MANHOLE
- SURFACE WATER MANHOLE
- ATTENUATION
- PERMEABLE PAVING
- RAINWATER PIPE
- BIORETENTION PLANTER

CLIENT: MICHAEL JOHN HUGHES

SITE: 41 BEACH ROAD, EMSWORTH, HAVANT, PO10 7HR

DRAWING: SURFACE WATER DRAINAGE LAYOUT

DRAWING NUMBER: AEG0493_DR001

DATE: 01/06/2023

REV: A

DRAWN BY: JA

DRAWING SCALE: NTS

PRELIMINARY DRAWING
FOR PLANNING ONLY - NOT FOR
CONSTRUCTION

aegaea

Flood risk, water and environment

Appendix E - InfoDrainage Calculation Results

Project:	Date: 26/05/2023		
	Designed by: Chris	Checked by:	Approved By:
Report Details: Type: Inflows Storm Phase: Phase	Company Address:		



Roof

Type : Catchment Area

Area (ha)	0.046
-----------	-------

Preliminary Sizing

Volumetric Runoff Coefficient	0.900
Percentage Impervious (%)	100
Time of Concentration (mins)	5

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.900
Winter Volumetric Runoff	0.900
Time of Concentration (mins)	5
Percentage Impervious (%)	100



Driveway

Type : Catchment Area

Area (ha)	0.02
-----------	------

Preliminary Sizing

Volumetric Runoff Coefficient	0.900
Percentage Impervious (%)	100
Time of Concentration (mins)	5

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.900
Winter Volumetric Runoff	0.900
Time of Concentration (mins)	5
Percentage Impervious (%)	100



Existing Impermeable

Type : Catchment Area

Area (ha)	0.075
-----------	-------

Preliminary Sizing

Volumetric Runoff Coefficient	0.900
Percentage Impervious (%)	100
Time of Concentration (mins)	5

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.900
Winter Volumetric Runoff	0.900
Time of Concentration (mins)	5
Percentage Impervious (%)	100

Project:	Date: 26/05/2023			
	Designed by: Chris	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Storm Phase: Phase				



Porous Paving

Type : Porous Paving

Dimensions	
Exceedance Level (m)	4.700
Depth (m)	0.200
Base Level (m)	4.500
Paving Layer Depth (mm)	5
Membrane Percolation (m/hr)	3.0
Porosity (%)	30
Length (m)	20.000
Long. Slope (1:X)	200.00
Width (m)	10.000
Total Volume (m³)	11.700

Inlets	
Inlet	
Inlet Type	Lateral Inflow
Incoming Item(s)	Driveway
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets	
Outlet	
Outgoing Connection	2.001
Outlet Type	Free Discharge

Advanced	
Conductivity (m/hr)	500.0

Project:	Date: 26/05/2023		
	Designed by: Chris	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		



Cellular Storage

Type : Cellular Storage

Dimensions

Exceedance Level (m)	4.700
Depth (m)	0.500
Base Level (m)	3.700
Number of Crates Long	1
Number of Crates Wide	1
Number of Crates High	1
Porosity (%)	95
Crate Length (m)	10
Crate Width (m)	9
Crate Height (m)	0.5
Total Volume (m³)	43.250

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	1.002
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	1.003
Outlet Type	Free Discharge

Project:	Date: 26/05/2023			
	Designed by: Chris	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	10
Junction Flood Risk Margin (mm)	300
Perform No Discharge Analysis	☐

Rainfall		
FSR	Type: FSR	
Region	England And Wales	
M5-60 (mm)	19.0	
Ratio R	0.350	
Summer	☒	
Winter	☒	

Return Period	
Return Period (years)	Increase Rainfall (%)
1.0	0.000
30.0	0.000
100.0	0.000
30.0	40.000
100.0	45.000

Storm Durations	
Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880

Project:	Date: 26/05/2023		
	Designed by: Chris	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase		Company Address:	





FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)
Porous Paving	FSR: 1 years: +0 %: 480 mins: Summer	4.640	4.509	0.040	0.009	0.6	2.036	0.000	0.000	0.3	4.553	82	82.601
Cellular Storage	FSR: 1 years: +0 %: 240 mins: Summer	3.765	3.765	0.065	0.065	2.3	5.597	0.000	0.000	0.8	8.328	99	87.060

Project:	Date: 26/05/2023			
	Designed by:	Checked by:	Approved By:	
	Chris			
Report Details:	Company Address:			
Type: Stormwater Controls Summary				
Storm Phase: Phase				

Status
OK
OK

Project:	Date: 26/05/2023		
	Designed by: Chris	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase		Company Address:	





FSR: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residant Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)
Porous Paving	FSR: 30 years: +0 %: 240 mins: Summer	4.693	4.516	0.093	0.016	2.3	4.143	0.000	0.000	0.9	7.319	50	64.592
Cellular Storage	FSR: 30 years: +0 %: 360 mins: Winter	3.907	3.907	0.207	0.207	2.6	17.704	0.000	0.000	0.8	14.598	364	59.065

Project:	Date: 26/05/2023			
	Designed by:	Checked by:	Approved By:	
	Chris			
Report Details:	Company Address:			
Type: Stormwater Controls Summary				
Storm Phase: Phase				

Status
OK
OK

Project:	Date: 26/05/2023		
	Designed by: Chris	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		





FSR: 100 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)
Porous Paving	FSR: 100 years: +0 %: 240 mins: Summer	4.721	4.518	0.121	0.018	2.9	5.240	0.000	0.000	1.2	9.728	46	55.214
Cellular Storage	FSR: 100 years: +0 %: 360 mins: Winter	3.996	3.996	0.296	0.296	3.5	25.274	0.000	0.000	0.8	14.951	668	41.564

Project:	Date: 26/05/2023			
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	Chris			
Report Details:	Company Address:			
Type: Stormwater Controls Summary				
Storm Phase: Phase				

Status
OK
OK

Project:	Date: 26/05/2023		
	Designed by: Chris	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		





FSR: 30 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)
Porous Paving	FSR: 30 years: +40 %: 240 mins: Summer	4.729	4.519	0.129	0.019	3.2	5.578	0.000	0.000	1.3	10.494	45	52.329
Cellular Storage	FSR: 30 years: +40 %: 480 mins: Winter	4.028	4.028	0.328	0.328	3.0	28.061	0.000	0.000	0.7	21.587	753	35.120

Project:	Date: 26/05/2023			
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	Chris			
Report Details:	Company Address:			
Type: Stormwater Controls Summary				
Storm Phase: Phase				

Status
OK
OK

Project:	Date: 26/05/2023		
	Designed by: Chris	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		





**FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By:
Max. Avg. Depth**

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)
Porous Paving	FSR: 100 years: +45 %: 240 mins: Summer	4.773	4.523	0.173	0.023	4.3	7.251	0.000	0.000	1.9	14.500	41	38.024
Cellular Storage	FSR: 100 years: +45 %: 480 mins: Winter	4.186	4.186	0.486	0.486	4.2	41.534	0.000	0.000	0.7	23.102	2042	3.967

Project:	Date: 26/05/2023			
	Designed by:	Checked by:	Approved By:	
	Chris			
Report Details:	Company Address:			
Type: Stormwater Controls Summary				
Storm Phase: Phase				

Status
OK
OK